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(54) **ADJUSTABLE BED SOLUTION**

LÖSUNG FÜR EINSTELLBARES BETT

SOLUTION DE LIT RÉGLABLE

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Description

[0001] This invention concerns an adjustable bed solution intended for use in care and bed wards in hospitals, health centers, nursing homes, rehabilitation centers and homes. The adjustable bed consists of the sleeping platform frame structure supported by the adjustable pedestal structure and the height adjustable support framework for the backrest plate of the seat module attached to the sleeping platform frame structure and the seat module integrated to the foot end of the sleeping platform frame structure.

1. The use of the product according to the invention

[0002] The functional characteristics of the adjustable bed solution of the invention are universal and versatile. It is suitable for demanding intensive care in hospitals as well as for use in rehabilitation centers, nursing homes and homes. The invention facilitates the work of nursing staff and caregivers in various care institutions and homes, and promotes rehabilitation and mental well-being of the patients and people with disabilities.

2. Prior art solutions

[0003] Adjustable bed solutions are used in care and bed wards in hospitals, health centers, nursing homes, rehabilitation centers and homes. The adjustments of the beds are performed either mechanically or electrically. The versatility of the adjustments ranges from simple, such as used in basic home care beds, to functionally demanding intensive care bed adjustments and their other advanced intelligent features. In simple bed applications used in homes and bed wards of care institutions and hospitals the basic adjustments are the adjustments of the back and foot sections of the sleeping platform, which allow the user to lie in bed in a comfortable position or to have the treatment position appropriate within the possibilities of the available control options. (Fig.31).

[0004] In addition to the above-described basic adjustments of the sleeping platform, the following adjustments are used in the traditional adjustable beds: The height adjustment of the sleeping platform structure and its longitudinal tilt adjustment to the so-called Trendelenburg and counter-Trendelenburg positions (Fig.32 and Fig.33) and the lateral tilt adjustment of the sleeping platform structure (Fig.35b and Fig.41). Further developed intensive care beds can also be adjusted to different seating positions used in post-treatment therapies to prevent complications that occur for the long time motionless patients. (Fig.37 and Fig.38). The adjustment mechanisms of the height adjustment and the longitudinal and lateral tilt adjustment of the conventional adjustable beds do not enable, as in the case of the present invention, a universal solution that contains all known adjustment options of the adjustable beds. For example, there are no known solutions for connecting the so called stand-up bed func-

tion (Fig.39) to an advanced adjustable bed otherwise equipped with the most versatile control functions of the bed.

[0005] Closest to the functional principle of the adjustable bed solution of the invention are solutions, where a part of the bed structure laterally moves and transforms into a wheelchair (Fig.44 ja Fig.45), and solutions in which a conventional wheelchair is connected to the U-shaped bed frame structure through the foot end of the bed structure. (Fig.46 - Fig.48). Sleeping platforms in the above-mentioned bed solutions are divided into functionally awkward longitudinal sections, which limits other possibilities for adjusting needed during nursing treatments, for example the adjustments to the Trendelenburg and counter-Trendelenburg positions of the bed. In the bed solutions presented in the pictures Fig.46, Fig.47 and Fig.48 the wheelchairs are positioned deep in the middle of the bed structure. Moving to or out of the bed requires the presence of a caregiver.

[0006] In connection with the conventional bed solutions, moving to the bed is done by sitting on the edge of the bed and with the help of a rise assist handle bending down to reclining position or, respectively, by rising up to the sitting position on the edge of the bed and moving to the wheelchair adjacent to the bed. This is difficult for people with reduced mobility. Alternatively, the patient is transferred in a lying position from the shower trolley or transfer bed to the bed with the help of sliding sheets or the patient is lifted there from a wheelchair by means of a sling lift (Fig.43). Some wheelchair solutions and geriatric nursing chairs have similar adjustment movements as being used in the adjustable beds. However, they are meant for short-term use. (Fig.40) Examples of known adjustable bed solutions are shown in the pictures Fig.31 - Fig.48.

[0007] Document US 2014/196207 A1 discloses an adjustable bed solution according to preamble of claim 1.

3. Disadvantages of prior art solutions

[0008] The work of nurses and caregivers of people with disabilities is physically demanding because of transferring the patients to and out of the bed. Disabled users of the conventional beds who are not able to move to the wheelchair next to the bed, are entirely dependent on their assistants. Specially in home care, the schedules of caregivers of people with disabilities and those with reduced mobility are busy and they can only be there occasionally. In the case of the above-mentioned bed solutions the presence of a caregiver is indispensable, if the user of the bed is not able, by means of a rise assist handle or the like, to move sideways on the sleeping platform to the "wheelchair section" in the middle of the sleeping platform. People with disabilities and people with reduced mobility want the help and presence of the caregiver when needed. Self-reliance and privacy are however of great importance to them. Traditional bed solutions provide limited opportunities for this.

4. Functional and structural characteristics of the adjustable bed solution of the invention (the basic idea of the invention)

[0009] The characteristics of the adjustable bed solution according to the invention are presented in the independent and undependent claims.

4.1 Main structural components of the adjustable bed solution of the invention:

[0010]

- The horizontal sleeping platform frame structure:
The sleeping platform frame structure (1), the support framework for the backrest plate of the seat module (2), the front beam (22), the seat module support profiles of the anchoring mechanism (33). 15
- The seat module:
The frame structure of the seat module (3b) with the motor and drive wheel bogie and the anchoring support and guide profiles. The seat plate (16) and the backrest plate (15) with the adjustable armrests (20) and the adjustable foot plates (17 and 18) are attached to the frame structure of the seat module. 20 25
- The sleeping platform structure:
The sleeping platform assembly consists of the horizontal sleeping platform structure and integrated seat module (3a). The bedstead is formed by the backrest plate, the seat plate and the foot plates of the seat module, the adjustment mechanisms of which are placed in the frame structure of the seat module (3b). 30
- The adjustable pedestal structure supporting the sleeping platform structure:
The adjustable pedestal structure of the bed (4) is used to adjust the height position of the sleeping platform structure and the longitudinal tilt position of the bed. The adjustable pedestal structure forms a functionally completely new type of adjustable bed solution with the sleeping platform frame structure (1) and the height adjustable support framework for the backrest plate of the seat module (2) and the seat module (3a) integrated to the sleeping platform frame structure. 35 40 45

[0011] The adjustable bed solution of the invention is supplemented by the patent application No. 20170128 of the adjustable pedestal structure of the bed. 50

4.2 Adjustments of the adjustable bed solution of the invention:

[0012]

- The height adjustment of the sleeping platform structure: The adjustment allows the adjusting of the sleeping platform frame structure (1) from the lowest 55

height position to the treatment height position and from there to the vertically upright position of the sleeping platform structure.

- The longitudinal tilt adjustment of the sleeping platform frame structure which allows the Trendelenburg and counter-Trendelenburg positions as well as the stand-up position of the bed.
- The longitudinal tilt adjustment of the sleeping platform frame structure is supplemented by the adjustments of the backrest plate and the adjustable foot plates of the seat module. These adjustments can be used to implement the nursing treatment and lying positions in which the upper body and / or the legs are lifted up. The variations of the above-mentioned adjustments also allow the different seating positions of staying in bed and the positions used in post-treatment and physiotherapeutic rehabilitation.
- The longitudinal adjustment (47) of the foot plates of the seat module (17 and 18) has an important ergonomic significance in the different position variations of the bed.
- The lateral tilt adjustment of the sleeping platform structure (Fig.27 and Fig.28) makes it easier to change the position of the patient and to ensure the stability of the side position during the treatment operations.

4.3 Specific features of the adjustable bed structure of the invention and differences between conventional solutions:

[0013]

- The adjusting functions of the adjustable bed solution of the invention include all known adjusting movements used in conventional adjustable beds.
- Moving to and out of the bed takes place through the foot end of the bed either by means of the anchored seat module equipped with wheels or through the stand-up position of the bed. The action can be done independently without caregivers. The most important difference and the completely new functional feature between the adjustable bed solution of the invention and the conventional bed solutions is the fact that also the users with reduced mobility can move to and out of the bed independently.
- The sleeping platform assembly of the bed consists of the combination of the sleeping platform structure and the anchored seat module (3a). The seat module is a structural part of the sleeping platform structure, not a separate conventional wheelchair attached to the sleeping platform structure, although it in independent use operates in a similar way.
- There is no need to specify where the universal bed solution of the invention is used, unlike in case of the

conventional bed solutions, where the beds with various adjustment options are classified according to specifically defined target groups.

- The adjustable pedestal structure of the bed (4) of the invention is compact and in its lowest height position structurally low. The structural solution of the pedestal structure allows unlimited longitudinal tilt adjustments of the sleeping platform structure to the Trendelenburg and counter-Trendelenburg and stand-up positions of the bed. It also allows the space for the movement of the anchored seat module (3a) that follows the tilt movement of the sleeping platform structure.

5. Advantages of the adjustable bed solution according to the invention

[0014] The important advantage of the adjustable bed solution of the invention is to facilitate the hard work of nurses and caregivers in hospitals, nursing homes, health and rehabilitation centers and homes. Patients and other long-standing users of the bed do not need to be transferred to and out of the bed with patient lifts. Even people with reduced mobility who, however, are able to walk, do not need to go to bed sitting on the edge of the bed and using rise assist handles. The action that requires physical strength is no longer necessary. Changing position in the bed is easy.

[0015] In hospitals patients usually spend shorter periods of time compared to people with disabilities and people with reduced mobility, who in home care or long-term institutional care have to spent years only lying in bed. The invention makes it possible for them to even have the chance to independently move out of bed and back to it. They can move in their home or in the common living areas of the rehabilitation centers and other care institutions instead of being bedded days around. This new opportunity will allow them to participate in the normal everyday life again.

[0016] By means of the universal bed solution of the invention - within one and the same structural solution - all different adjustment movements used in nursing treatment, post-treatment and physiotherapeutic rehabilitation can be performed. The adjustable bed solution of the invention is thus suitable for use to all different target groups from homes to hospitals. Requirements for the functional features of the beds used in hospitals, care institutions, rehabilitation centers and homes vary from simple applications to functionally demanding and versatile adjustment features. By means of the adjustable bed solution of the invention, a functional and economically optimized bed for each target group can be implemented.

6. A detailed technical description that follows the reference numbers used in the drawings

Fig.1

[0017] The axonometric picture shows the main components of the adjustable bed solution of the invention: The sleeping platform frame structure (1), the support framework for the backrest plate of the seat module (2), the frame structure of the seat module (3b) integrated to the sleeping platform frame structure and the adjustable pedestal structure of the bed (4) which carries the sleeping platform structure.

Fig.2

[0018] The axonometric picture shows the horizontal sleeping platform frame structure (1) and the frame structure of the seat module (3b) equipped with wheels integrated to it and the adjustable pedestal structure (4) which carries the sleeping platform structure. The backrest plate (15), the seat plate (16) and the foot plates (17 and 18) of the seat module integrated to the sleeping platform frame structure together with the sleeping platform frame structure and the support framework for the back plate of the seat module (2) attached to it form the sleeping platform structure of the bed (Fig.3).

[0019] The longitudinal tilt position adjustment of the sleeping platform frame structure performed by means of the adjustable pedestal structure of the bed is supplemented by the adjustment of the support framework for the backrest plate of the seat module (2). The support framework for the backrest plate is connected to the horizontal sleeping platform structure through the rotation axle (9). The adjustment of the support framework for the backrest plate is made by means of the adjusting actuator (50) and the scissor lift mechanism (51) attached to the sleeping platform frame structure. Variations of the sleeping, sitting and standing positions of the bed are generated from combinations of the adjusting movements of the above-mentioned structures and plates of the seat module.

[0020] The anchoring locking mechanism (34) for the frame structure of the seat module (3b) and the seat module support profiles of the anchoring mechanism (33a) are connected to the front beam of the sleeping platform frame structure (22).

[0021] The structural solution of the adjustable pedestal structure of the bed (4) consists of the two parallel lever arm (6) assemblies which are connected to each other through the rotation cylinders (7) equipped with adjusting actuators that move the lever arms. The lever arm assemblies and the rotation cylinders are supported by the U-shaped foot structure of the pedestal (5). The sleeping platform frame structure of the bed is supported by the sleeping platform support lever arms (9) of the upper structural part of the pedestal structure. The support lever arms are connected to the support plate profiles

of the sleeping platform frame structure (10). The adjustable pedestal structure is protected by cover plates (8) attached to the lever arms.

Fig.3

[0022] The axonometric picture shows the sleeping platform frame structure of the adjustable bed solution of the invention in the horizontal position and adjusted to its lowest position. The height adjustable support framework for the backrest plate of the seat module (2) and the backrest plate of the seat module (15), which freely follows its adjustment movement of the support framework, have been adjusted to the lowest position. The foot plate part 2 of the seat module (18) is adjustable in the longitudinal direction of the sleeping platform structure (Fig.24).

[0023] The adjustable armrests (20) of the seat module are integrated into the backrest plate of the seat module (15). The adjustment movement happens through the rotation axle (13) of the armrests. The armrests are in the lying position of the bed. The headboard of the sleeping platform structure (19) attached to the sleeping platform frame structure (1) can be removed during the nursing treatment operation if necessary.

Fig.4

[0024] The axonometric picture shows the sleeping platform structure of the bed adjusted to the treatment height position. The adjustable bed railings (62) are connected to the sleeping platform frame structure (1). By means of the telescopic part of the bed railing structure (63) the length of the bed railings can be adjusted according to the operational situation, (Fig.29 and Fig.30). The control panel of the adjustments of the bed (60) is connected to the bed railing assembly. The lateral tilt mechanism of the bed (57) is located in the foot structure of the pedestal (5). The lifting wheel mechanisms of the lateral tilt adjustment of the bed (57) are placed in the foot structure of the pedestal (5). The lifting wheels are in the upper position in the picture, (Fig.27 and Fig.28)

Fig.5

[0025] The axonometric picture shows the sleeping platform frame structure of the adjustable bed solution of the invention in the sitting position. The backrest plate of the seat module (15) is resting on the upwardly adjusted support framework for the backrest plate of the seat module (2). The tilt position adjustment of the backrest plate and foot plates of the seat module (17 and 18) happens through the rotation axles (11 and 12) which are located on the front and rear edges of the seat plate of the seat module (16). The backrest plate follows freely the tilt movement of the height adjustable support framework for the back plate of the seat module (2). The foot plates are adjusted by means of their own adjusting

mechanisms. The motion-specific adjustment mechanisms allow the unlimited adjustment variations of the sleeping, sitting and standing positions of the bed.

Fig.6

[0026] The axonometric picture shows the same situation where the frame structure of the seat module (3b) is anchored to the sleeping platform frame structure of the bed (1) as shown in the previous picture Fig.5. The tilt angles of the height adjustable support framework for the backrest plate of the seat module (2), on which the backrest plate of the seat module (15) is resting, as well as the sleeping platform frame structure (1) and the foot plates of the seat module (17 and 18), can individually be adjusted according to the different lying, seating and standing positions of the bed.

Fig.7

[0027] The axonometric picture shows the adjustable bed solution of the invention when the seat module (3a) is in the anchoring position. The foot plates of the seat module (17 and 18) are adjusted to the lowest position and the adjustable armrests of the seat module (20) are in the sitting position. The height adjustable support framework for the backrest plate of the seat module (2) has been adjusted to the upper position and it has raised the backrest plate of the seat module (15) to the upright position. When the foot plates of the seat module (17 and 18) descend to the lowest position, the locking mechanism of the backrest plate of the seat module (43) will be activated in the final stage of the movement and prevents the backrest plate (15) from tilting backwards, when the anchoring locking mechanism for the seat module (34) releases the seat module and it exits anchoring, (Fig.23). Conversely, when the seat module (3a) is anchored to the sleeping platform frame structure (1), first the anchoring locking mechanism for the seat module (34) will be activated. Thereafter, a small adjusting tilt movement upward of the foot plate assembly releases the locking mechanism of the backrest plate of the seat module (43). The backrest plate of the seat module (15) then leans on the adjustable support framework for the backrest plate of the seat module (2) and tilts freely following its adjustment movement.

Fig.8

[0028] The axonometric picture shows the seat module (3a) when it has been disconnected from the sleeping platform frame structure (1) and operates independently. The backrest plate of the seat module (15) is locked upright. The foot plate assembly of the seat module is adjusted to the sitting position and the armrests of the seat module (20) are adjusted in the operating position. The upper backrest plate (14) is attached to the height adjustable support framework for the backrest plate of the

seat module (2). It may also be an extension part of the backrest plate of the seat module (15), thus forming a high backrest plate (69) which supports the head of the person sitting in seat module.

Fig.9

[0029] The axonometric picture shows the seat module (3a) in the anchoring position. The adjustable pedestal structure of the bed (4) is in the lowest position and the sleeping platform structure is in the horizontal position. The backrest plate of the seat module (15) is in the upright position and the locking mechanism of the backrest plate of the seat module (43) is active. The foot plates of the seat module (17 and 18) are adjusted to the lower position. The armrests of the seat module (20) have been adjusted to the operating position (41) and the operating switch of the seat module (42) is adjusted out for use from the armrest structure.

Fig.10

[0030] The axonometric picture shows the seat module (3a) when it has been released from the anchoring. The seat module is equipped with a lap belt, that prevents the user from falling or with support belts which hold the sitting position of the user of the seat module straight when the seat module has a high backrest plate.

Fig.11

[0031] The axonometric picture shows the adjustable bed structure the foot end of the sleeping platform frame structure (1) upwardly adjusted. The sleeping platform frame structure is adjusted to the Trendelenburg position by means of the adjustments of the adjustable pedestal structure of the bed (4). The sleeping platform structure can be adjusted from the lower height of lying in bed to the treatment height position. When the support framework for the backrest plate of the seat module (2) is lowered down, the bed user lays head down in the bed. Due to the structural solution of the adjustable pedestal structure of the bed (4), the desired angle of inclination of the Trendelenburg adjustment can be selected freely - as well as in the counter-Trendelenburg position, which maximally allows the stand-up position of the bed, but in the opposite direction. In the conventional bed solutions, the lifting mechanisms under the sleeping platform structure do not allow corresponding unlimited tilt angle adjustments of the sleeping platform. Compare the adjustable bed solution of the invention with the conventional bed solutions shown in the pictures Fig.32 and Fig.33.

Fig.12

[0032] The axonometric picture shows the sleeping platform frame structure (1) of the bed adjusted to the counter-Trendelenburg position. The adjustable bed rail-

ing assembly (62) can be adjusted to the lower position during the treatment operation. By increasing the tilt angle of the sleeping platform frame structure, the bed structure will be transformed into the stand-up bed.

Fig.13

[0033] The axonometric picture shows the adjustable bed of the invention in the stand-up position. The armrest of the seat module (20) are adjusted to the standing position to give support to the bed user. The bed users who are able to walk but due to various reasons, eg. after a hip surgery, are unable to bend their body, can also independently move to or out of the bed. In training of balancing organs in the so-called position treatment, the bed user is supported by means of support belts to standing position.

Fig.14

[0034] The axonometric picture from behind shows the adjustable bed in the stand-up position. The sleeping platform frame structure (1) of the bed is adjusted to the stand-up position by means of the 3-dimensional movements of the adjustable pedestal structure of the bed (4). The longitudinal adjustment of the foot plate part 2 (47) of the seat module, on which the standing occurs, allows the standing height in the stand-up position of the bed, as well as the length of the sleeping platform frame structure in the lying position of the bed, to be adjusted to suit all different lengths of users of the bed.

[0035] The control unit of the pedestal structure (53) is positioned behind the cover plate (8) between the lever arms (6) of the lowest structural part of the adjustable pedestal structure (4) of the bed. The display panel of the operating codes of the adjusting actuators (61) and the electrical connection plug of the bed structure are located at the rear surface of the foot structure of the pedestal (5). The control unit of the actuators of the sleeping platform structure and the seat module (54) are placed inside the sleeping platform frame structure (1) under the support framework for the backrest plate of the seat module (2). The adjustment actuators for the backrest plate of the seat module (15) and the foot plates of the seat module (17 and 18) receive operating voltage, through the charging and wiring plug (27) attached to the sleeping platform frame structure when the seat module is anchored to the sleeping platform. The control unit of seat module for the independent use (55) is placed in the frame structure of the seat module (3b), (Fig. 17). It controls the motor and drive wheel bogie (31) when the seat module is disconnected from the rest of the sleeping platform structure. The battery placed in frame structure of the seat module and the operating switch of the seat module (42) integrated into the armrest of the seat module also allow the independent use of the seat module.

[0036] The operating voltage of the adjusting actuators and control units of the bed structure is 12V / 24V. The

operating adjustments of the bed are performed by means of the control panel of the adjustments of the bed (60) attached to the adjustable bed railing assembly (62). The bed structure is equipped with safety mechanisms which stop the adjustment movement when an obstacle appears. The movements are: Up- and-down movements of the adjustable pedestal structure of the bed (4), up-and-down and tilt adjusting movements of the horizontal sleeping platform frame structure (1), the downward adjusting movement of the support framework for the backrest plate of the seat module (2) and the adjustment movements of the foot plates of the seat module (17 and 18). The safety sensors (72) are connected to the cover plate on the underside of the sleeping platform structure (70) and to the cover plates of the adjustable pedestal structure (8) and to the underside of the structural profiles of the horizontal sleeping platform frame structure (1) and to the underside of the support framework for the backrest plate of the seat module (2). The downward movement of the foot plates of the seat module is protected by safety sensors (71) placed on the front edge of the frame structure of the seat module (3b).

Fig.15a

[0037] The sectional pictures Fig.15a, Fig.15b and Fig.15c show the function of the backrest plate locking mechanism of the seat module in the stand-up position of the bed. When the seat module (3a) is anchored to the sleeping platform frame structure (1) of the bed structure the backrest plate of the seat module (15) rests freely on the support framework for the backrest plate of the seat module (2) and tilts through its rotation axle (11) and follows the up and down adjusting movement of the support framework. The rotation axle of the support framework for the backrest plate of the seat module (9) and the rotation axle of the backrest plate of the seat module (11) are positioned side by side attached to the sleeping platform frame structure. Different tilt positions of the backrest plate of the seat module (15) of the are called the Fowler's positions. They are used in the so-called position treatments combined with other adjustments and positions of the bed structure.

Fig. 15b

[0038] When the sleeping platform structure of the bed is adjusted to the stand-up position of the bed, the sleeping platform frame structure (1) and the anchored seat module (3a) - the backrest plate (15) of which is shown in the picture - tilt from the horizontal to about 85 degrees. In the final step of the adjustment movement, the locking fitting (23) of the backrest plate locking mechanism in the stand-up position of the bed attached to the backrest plate of the seat module (15), which in other tilt positions of the sleeping platform frame structure hangs freely, is locked into the counter locking fitting (21) of the backrest plate locking mechanism placed in the sleeping platform

frame structure, and prevents the backrest plate from being folded forward. The locking mechanism of the backrest plate of the seat module (43) placed in the frame structure of the seat module (3b) is in the open position when the seat module is anchored to the sleeping platform frame structure.

Fig.15c

[0039] The backrest plate locking mechanism opens when the support framework for the backrest plate of the seat module (2) and the backrest plate of the seat module (15) resting on it tilt back from the stand-up position of the bed downwards to the horizontal position of the sleeping platform frame structure. The locking fitting (23) attached to the backrest plate of the seat module hangs freely again.

Fig. 16

[0040] The pictures show the various positions of the locking fitting (23) of the backrest plate locking mechanism in the stand-up position of the bed attached to the backrest plate of the seat module (15) in the horizontal and stand-up positions of the bed.

Fig.17

[0041] The axonometric picture shows the anchoring of the seat module (3a) to the sleeping platform frame structure (1) of the bed. The seat module support profiles of the anchoring mechanism (33a) taper in V-shape towards the front beam of the sleeping platform frame structure (22), where the anchoring locking mechanism (34) for the seat module is located. The anchoring support and guide profiles (52) placed on the sides of the frame structure of the seat module (3b) respectively taper in V-shape towards the front part of the seat module. This solution provides lateral looseness to anchoring. The seat module does not have to be fully perpendicular to the sleeping platform frame structure as the guide bearings (33b) work like a slide mechanisms.

[0042] When the anchoring occurs, the sleeping platform structure of the bed is adjusted to its lowest position, where the seat module support profiles of the anchoring mechanism (33a) and the anchoring support and guide profiles (52) of the seat module frame structure (3b) are interlocked with each other. The height of the inner surface (a U-shape in upright position) of the anchoring support and guide profiles of the seat module is slightly higher than the height of the seat module support profiles attached to the to the sleeping platform frame structure. By means of the "expansion joint", the interleaving of the above-mentioned components is carried out flexibly without friction.

[0043] When the seat module (3a) is positioned near the seat module support profiles (33a) at the foot end of the sleeping platform frame structure (1), the distance

required to complete the anchoring is short, since the structural depth of the anchoring mechanism in the direction of the movement is very short. Compare with the conventional bed structure solutions shown in the pictures Fig.46 - Fig.48, where a conventional wheelchair is supported by sliding rails in the middle of the U-shaped bed structure. The integration distance of the wheelchairs into the U-shaped bed structure is significantly longer.

[0044] The adjustable foot plates of the anchored seat module (17 and 18) locating at the end of the sleeping platform frame structure (1) are left free from other structures. The nursing staff and other caregivers may, if necessary, without any obstacles correct the position of the feet of the person sitting in the seat module or otherwise change his or her sitting position. Compare with the bed solutions shown in the pictures Fig.46 - Fig.48. The placement of the adjustable bed solution of the invention in small room spaces in homes and in the bed wards of care institution is easier to execute, since when the seat module (3a) is in independent use, is the length of the remaining bed structure essentially shorter as the length of the conventional bed solutions mentioned above - it is the same as the length of the sleeping platform frame structure (1) of the bed. There is more free space for walking available at the end of the remaining structural part of the bed. The picture shows the location of the charging and wiring plug (27) and the optical position sensor of the seat module (28) placed on the back plate of the frame structure of the seat module (3b) and the location of their counterparts placed on the underside of the front beam of the sleeping platform frame structure (22).

Fig.18

[0045] The axonometric picture shows the frame structure of the seat module (3b) anchored to the sleeping platform frame structure (1). The anchoring support and guide profiles (52) of the seat module and the seat module support profiles (33a) attached to the sleeping platform frame structure (1) are linked to each other. The anchoring locking levers (35) placed on the front beam of the sleeping platform frame structure (22), connect the seat module as part of the sleeping platform structure of the bed, wherein the backrest plate (15), the seat plate (16) and the foot plates of the seat module (17 and 18) form the bedstead / sleeping platform of the bed. The direction of the motor and drive wheel bogie (31) attached to the base plate of the frame structure of the seat module (3b) is changed by means of the motor (36) and the toothed belt mechanism (37). The control unit of the seat module (55) and the power supply battery are located in the space between the base plate and the seat plate of the seat module (16).

Fig.19

[0046] The axonometric picture shows the anchoring

locking mechanism of the adjustable bed structure of the invention. The anchoring locking mechanism (34) is positioned in the front beam of the sleeping platform frame structure (22). The actuator (40) moves the locking shaft so that the locking lever (35) is in the open position when the seat module has been released from the anchoring and in the locking position when the seat module is anchored to the sleeping platform frame structure.

Fig.20

[0047] The axonometric picture shows the seat module (3a) viewed from behind. The locking fittings of the backrest plate locking mechanism in the stand-up position of the bed (23), as well as the support fittings of the headrest (26) required on a case-by-case basis, are attached to the rear surface of the backrest plate of the seat module (15). The adjustable armrests of the seat module (20) are attached to the backrest plate and they are located on the front side of it. The adjusting movement of the armrests from the sleeping position to the sitting position happens through the rotation axle (13) located in the armrest structure by means of the adjusting actuator of the armrests (24) and the toothed belt mechanism (25) attached on the rear surface of the backrest plate.

[0048] The charging and wiring plug (27) and the optical position sensor (28) of the electrically functioning seat module are placed on the rear plate of the frame structure of the seat module (3b). They are connected to the junction box placed on the front beam of the sleeping platform frame structure (22) when the seat module is anchored to the sleeping platform frame structure (1). The bed user can perform the automated anchoring independently without a caregiver. When the anchoring occurs, the optical position sensor of the seat module (28) indicates with sound and / or light signals the distance between the seat module and the anchoring mechanism (33) locating at the foot end of the sleeping platform frame structure. After the anchoring, the user of the bed moves to reclining position with the help of the adjusting movement of the support framework for the backrest of the seat module (2) and the simultaneous movement of the backrest plate of the seat module (15) resting on the support framework, and the adjusting movements of the foot plate assembly of the seat module. By means of the control panel of the adjustments of the bed (60) attached to the adjustable bed railing assembly (62), the user of the bed can perform the adjustments of the bed and he or she is able to move to or out of bed independently without the presence of the caregiver required in connection with conventional beds.

Fig.21

[0049] The axonometric pictures show the frame structure of the seat module (3b) and the function of the motor and drive wheel bogie (31). The seat module is controlled by means of the operating switch (42) positioned in the

armrest of the seat module (20). Moving forwards and backwards is done by turning the direction of the motor and drive wheel bogie and changing the rotation direction of the wheels.

[0050] The direction of the motor and drive wheel bogie (32) attached to the base plate of the frame structure of the seat module can be turned 180 degrees. This allows the lateral movement of the seat module, so that for example moving between the table and the back wall of the room requires less space than moving with a conventional electrically powered wheelchair.

Fig.22

[0051] The axonometric picture shows the seat module (3a) viewed from the front. The seat plate of the seat module (16) is shown as transparent. When the sleeping platform structure of the bed is adjusted from the lying position to the anchoring position, the backrest plate of the seat module (15) tilts through its rotation axle (11) upwards about 85 degrees from the horizontal plane, lifted by the adjustment movement of the support framework for the backrest plate of the seat module (2). The rotation axle is placed at the rear edge of the seat plate of the seat module (16). Simultaneously the foot plates of the seat module (17 and 18) are adjusted down to the sitting position and the locking mechanism of the backrest plate of the seat module (43) is activated and it locks the backrest plate to the upright position, preventing it from tilting backward when the seat module is released from the anchoring.

[0052] The foot plate assembly of the seat module is in the sitting position in the picture. The tilt position of the foot plates is adjusted through the rotation axle (12) positioned at the front edge of the seat plate of the seat module (16). The adjusting movement of the armrests of the seat module (20) happens through the rotation axle (13) locating in the armrests structure by means of the adjusting actuator (24) and toothed belt mechanism of the armrests (25). The adjustment is complemented by actuators placed in the armrest structure, which rotate the armrests to the operating position of the armrests (41), and simultaneously turn up the into the armrest structure integrated operating switch of the seat module (42) ready for use.

Fig.23

[0053] The axonometric picture shows the function of the backrest plate (15) and the foot plates of the seat module (17 and 18) in the sitting position. The seat plate of seat module (16) is shown as transparent. The foot plates of the seat module (17 and 18) form a two-part adjustable foot plate assembly. The foot plates are connected to each other by means of the sliding rails (44b). (Two parallel sliding rails are shown in the picture.) The foot plate part 1 of the seat module (17) is attached to and supported by the rotation axle (12) at the front edge of the seat plate of the seat module (16). The adjustment

of the tilt angle of the foot plate assembly is made through the rotation axle (12) from the lying position to the sitting position of the bed. The tilt adjustment is made by means of the actuator (45) attached to the lower surface of the seat plate (16) and connected to the foot plate part 1 of the seat module (17).

[0054] The locking mechanism of the backrest plate of the seat module (43) is attached to the underside of the seat plate of the seat module (16). The locking mechanism consists of the locking plate (73) connected to the lower part of the sliding rail of the backrest locking mechanism (44a) and the push lever of the locking plate (74) connected to the foot plate part 1 of the seat module (17). The push lever moves the locking plate toward the locking plate part (38) in the lower edge of the backrest plate of the seat module (15) when the foot plates tilt down to the sitting position.

[0055] The locking of the backrest plate to the upright position occurs during the final step of the tilt adjustment of the foot plate assembly to the lowest position and at the same time during the final movement (48) of the locking plate of the backrest plate locking mechanism (73). In the picture the foot plate assembly of the seat module is in the lowest position and the backrest plate (15) is locked to the upright position when the seat module (3a) is released from the anchoring. The locking will open after a short motion when the tilt angle of the foot plate assembly is adjusted from the sitting position toward the horizontal lying position of the bed after the anchoring has happened. The backrest plate rests freely again on the height adjustable support framework for the backrest plate of the seat module (2).

Fig.24

[0056] The axonometric picture shows the function of the backrest plate and the foot plate assembly of the seat module in the reclining position of the bed. The backrest plate (15) and the seat plate (16) and the foot plate part 1 of the seat module (17) are shown as transparent. The foot plate assembly is adjusted to the horizontal position by means of the tilt angle adjustment actuator (45) connected to the foot plate part 1 of the seat module. The foot plate part 2 of the seat module (18) connected to the foot plate part 1 (17) by means of sliding rails (44b) has been adjusted longitudinally to the outermost length (47). The adjustment is made by means of the actuator (46) attached to the foot plate part 1 (17) and connected to the foot plate part 2 of the seat module (18).

[0057] The importance of the adjustments of the foot plate assembly for the ergonomically properly dimensioning that follows the natural motion of the feet is the compensation in length by means of which the smaller overall structural length of the foot plate assembly in the lower sitting position, is increased to the larger total length required by the reclining position, or correspondingly the total length is shortened to a suitable length in the seating position. Due to the thickness of the mattress the length

of the trajectories from the tilt axle of the foot plate assembly (12) and the bending axis of the knees to the surface of the foot plate part 2 (18) against which the feet must be is different.

[0058] Without the co. compensation in length the situation arises, where the foot section of the sleeping platform structure is too short when the user is lying in the bed if the dimensioning is based on the length of the foot section in the sitting position. Or conversely, if the dimensioning is based on the adequate length of the foot section in the lying position, the dimension from the knee to the footboard will be too large - "the feet are left in the air". This phenomenon can clearly be seen in connection with the conventional bed solution shown in the picture Fig.35a, where the sleeping platform of the bed has been adjusted to the sitting position. In the conventional adjustable bed solution shown in the picture Fig.45, the foot section of the wheelchair is so short that the user him- or herself or the caregiver has to raise the feet onto the footboard of the wheelchair when the foot section has been adjusted to the sitting position.

[0059] The longitudinal adjustment movement of the foot plate assembly (47) also plays an important role when the sleeping platform structure is adjusted to the stand-up position of the bed. The length of the foot plate assembly can be adjusted individually according to the body length of each user of the bed, before adjusting the sleeping platform frame structure to the stand-up position of the bed, so that the foot plate part 2 is at the correct standing height at the end of the adjusting movement. The bed user will not glide downwards on the sleeping platform surface during the adjustment movement. The foot plate part 2 of the seat module on which the standing takes place, forms the foot end board of the sleeping platform structure when the bed is in the horizontal position. The longitudinal length adjustment of the foot plate assembly of the invention can also be utilized in the so-called position treatment and in the post-treatment, where the feet are supported against the endplate of the bed, which helps the patient to use breathing muscles and facilitates dyspnoea.

Fig.25

[0060] The axonometric picture shows the alternative solutions of the backrest plate of the seat module. In the left-hand picture the removable headrest of the seat module (49) has been attached to the backrest plate of the seat module (15). The task is performed by the caregiver. The right-hand picture shows the alternative solution in which the upper backrest plate (14) has been connected to the backrest plate of the seat module (15) thus forming the high backrest plate of the seat module (69) which supports the head of the person sitting in the seat module.

[0061] The mechanically functioning locking mechanism of the backrest plate of the seat module (43) can be replaced by means of the adjusting actuator attached to the seat plate (16) and connected to the locking plate

part of the backrest plate of the seat module (38). The push lever of the locking plate of the backrest plate locking mechanism (74) is also left out in this case. The electrically operated locking mechanism of the backrest plate is not dependent on the position of the foot plate assembly of the seat module. The backrest plate and the foot plate assembly of the seat module can be adjusted to half sitting / armchair position also when the seat module (3a) has been released from the anchoring. In the independent use of the seat module the adjustment of the backrest plate backward requires the use of the rear-mounted support wheels attached to the frame structure of the seat module to prevent the seat module from tilting backward

Fig.26

[0062] The axonometric picture from behind shows the middle part of the sleeping platform frame structure (1) in the stand-up position of the bed. The sleeping platform frame structure (1) of the bed is connected to the sleeping platform support lever arms (9) of the adjustable pedestal structure of the bed (4) by means of the support plate profiles (10) of the sleeping platform frame structure. The locking fitting of the backrest plate locking mechanism in the stand-up position of the bed (23) is locked into the counter locking fitting of the backrest plate locking mechanism (21) attached to the sleeping platform frame structure (1) and prevents the backrest plate of the seat module (15) from being folded forward when the sleeping platform structure of the bed is adjusted to the stand-up position.

[0063] The armrests of the seat module (20) integrated into the backrest plate of the seat module (15) can be adjusted to standing position to give support to the bed user in the stand-up position of the bed. The picture shows the positions of the adjustment mechanism of the height adjustable support framework for the backrest plate of the seat module (2). The adjusting actuator (50) and the scissor mechanism (51) are attached to the transverse beams of the sleeping platform frame structure (1). The downward adjusting movements are protected by means of safety sensors placed underneath the structural profiles of the sleeping platform frame structure and the support framework for the backrest plate of the seat module.

Fig.27

[0064] The sectional pictures show the lateral tilt adjustment mechanism of the sleeping platform frame structure (1) of the adjustable bed solution of the invention. By means of the lifting wheel mechanism of the lateral tilt adjustment of the bed (57) placed in the height adjustable foot structure of the pedestal (5), the bed structure can be tilted in lateral direction during the treatment operations and facilitate the work of nurses and caregivers when they change the position of the bed user. The

lateral tilt position of the bed is also used in the so-called position treatments to avoid the risks of for instance pressure sores. The lifting wheels on the selected side of the bed are adjusted down to the lifting position by means of the adjusting actuators whereby the particular side of the sleeping platform structure rises upwardly and the bed tilts sideways.

[0065] Locking of the drive wheels (30b) on the opposite side of the foot structure of the pedestal prevents the bed from sliding on the floor. The attention lights (59) placed on the sides of the foot structure of the pedestal and sound signals, warn that the tilt function is in progress. (See Fig.4)

Fig.28

[0066] The axonometric pictures show the lifting wheel mechanism of the lateral tilt adjustment of the bed (57) with the lifting wheels (30c) in the upper and lower positions. The adjusting of the lifting wheels is performed by means of the adjusting actuators (58) and lever mechanisms positioned inside the structural profiles of the foot structure of the pedestal (5).

Fig.29

[0067] The axonometric picture shows the adjustable bed railings (62) attached to the sleeping platform frame structure (1) of the adjustable bed solution of the invention. The bed railing is in the upper position. The adjustable support profiles of the bed railing (65) by means of which it is adjusted to the upper and lower positions (67), are supported on the underside of the structural profiles of the sleeping platform frame structure (1) of the bed. The bed railings are locked in the upper and lower positions by means of the locking switch (66) connected to the support profiles of the bed railings.

[0068] The bed railings consists of two structural parts: The structurally solid transparent protection plate surface (64) and the telescopic part (63) attached to it. The length of the bed railing assembly (68) can be adjusted by means of the telescopic part according to the functional situation. The bed railings prevent the bed user from falling from the bed and the protection plate surfaces limbs from being trapped during the adjustments of the bed structure.

Fig.30

[0069] The axonometric picture shows the adjustable bed railings (62) of the invention in the lower position. The telescopic part of the bed railing assembly has been pushed inside the structurally solid part of the bed railing assembly. The structurally solid part of the bed railing assembly consists of two transparent protection plate surfaces (64) between which the telescopic part of the bed assembly (63) moves in and out. The bed railing is raised from the lower position and locked with the locking

switch (66) to the upper position, after which the telescopic part of the bed railing assembly is pulled out.

Fig.31

[0070] The picture shows a typical structurally simple bed used in hospital wards and nursing homes. The bed has a 4-piece sleeping platform. The inclination adjustment of the back, hip, knee and foot section plates is performed mechanically. The bed structure is equipped with wheels and the bed railings can be raised up or lowered down.

Fig.32

[0071] The picture shows a typical adjustable bed used in hospital wards. The adjustment of the 4-piece sleeping platform is performed electronically. The height adjustment of the bed and the longitudinal tilt of the sleeping platform to the Trendelenburg and the counter-Trendelenburg positions is made by means of the pedestal structure equipped with wheels and placed under the sleeping platform structure. The scissor lift mechanism supporting the sleeping platform structure of the bed is adjusted by means of the actuators. The bed is in the Trendelenburg position in the picture. The adjustments are made by means of the manual controller hanging on the bed railing of the bed. Protection of the scissor lift mechanism in the open pedestal structure is difficult to implement. Ultimately, the safety of use is the responsibility of the nurse or caregiver who performs the adjustment movement of the bed.

Fig.33

[0072] The picture shows the sleeping platform structure of bed shown in the previous picture Fig.32 adjusted to the counter-Trendelenburg position. The bed is in a gently sloping sitting / lying position.

Fig.34

[0073] The picture shows an intensive care bed used in hospitals. The sleeping platform structure of the bed can be adjusted to the sitting position used in the position treatment of patients with respiratory illnesses. The adjustments are performed by means of the control panel attached to the bed railing structure.

Fig.35a

[0074] The picture shows an electrically adjustable bed used in hospitals and home care. The sleeping platform of the bed can be adjusted to the sitting position. The solution makes it easier to move to a standing position and leave the bed. If the bed user is not able to walk, he or she will be transferred to the wheelchair by means of a patient lift.

Fig.35b

[0075] The picture shows the bed solution shown in the previous picture Fig.35a. The other adjustments of the bed, in addition to the above-described adjustment to the sitting position of the bed, are the height adjustment and the adjustments to the Trendelenburg and the counter-Trendelenburg positions and the lateral tilt adjustment of the sleeping platform structure of the bed.

Fig.36

[0076] The sleeping platform structure of the bed solution shown in the picture can be rotated in a transverse direction of the bed and be adjusted to the sitting position.

Fig.37

[0077] The picture shows an intensive care bed used in hospitals. The backrest of the bed is in the Semi-Fowler's position used in the treatments of patients with heart diseases.

Fig.38

[0078] The picture shows an intensive care bed adjusted to the sitting position used in the treatment of patients with respiratory illnesses.

Fig.39

[0079] The picture shows the so-called stand-up bed with the sleeping platform structure adjusted in the up-right position. The other adjustments of the bed are the adjustment of the backrest plate and the height adjustment of the sleeping platform structure. The adjustments are performed by means of the electronically adjustable scissor lift mechanism placed under the sleeping platform frame structure. The bed has been developed for users who are unable to bend their body. The solution allows them to move to and out of bed with the body in straight position.

Fig.40

[0080] The picture shows an adjustable geriatric chair that can be adjusted from the lying position through the seating position to the standing position. Geriatric chairs are used in physiotherapeutic rehabilitation treatment, among others to stimulate the sense of balance and weight and to improve blood circulation.

Fig.41

[0081] The picture shows an intensive care bed adjusted to the lateral tilt position. Changing of the bed linens and cleaning the beds and other day-to-day nursing activities requires physical strength and often many per-

sons to carry the tasks. The lateral tilt adjustment facilitates the work of nurses and caregivers when they change the position of the bed user and ensures the stability of the position during the treatment operations. The automatic lateral therapy is a function where the bed is programmed to tilt regularly from side to side. This movement partly replaces the natural movement of the body and works to prevent serious lung complications.

Fig.42

[0082] The picture shows the unconscious patient being moved from the bed to a transfer bed with the help of a sliding sheets. The lateral tilt position of the bed facilitates the operation significantly. The actions mostly requires the presence of more than one nurse or other caregivers and physical strength.

Fig.43

[0083] The picture shows the patient being transferred from the bed by means of a sling lift. The sling lift is suspended either on the rail mechanism attached to the ceiling or on the patient lift equipped with wheels. Nursing workers have one of the highest risks of getting problems with the back. Back pains are usually the result of strain caused by changing the position of heavy patients during treatment procedures or by transferring them of the bed to the wheelchair by means of which the patient is transferred to the shower or to the toilet or elsewhere for examinations and therapies. This applies equally the work of nurses and caregivers in hospitals and nursing homes and homes.

Fig.44

[0084] The picture shows an adjustable bed solution, in which the sleeping platform structure of the bed has been divided into two longitudinal sections. The other side of the bed structure is pulled sideways out of the sleeping platform frame structure, after which it transforms into a wheelchair. The adjustments of the wheelchair are made electronically. The division of the sleeping platform into two sections is operationally problematic. Moving of the bed user unable to move him- or herself to the section of the sleeping platform structure transforming into a wheelchair, requires the help of the caregiver during the operation. The sleeping platform structure of the bed can not be adjusted in the height direction or to the Trendelenburg and counter-Trendelenburg positions.

Fig.45

[0085] The picture shows an adjustable bed solution whose functional principle is the same as in the above-mentioned bed solution. The sleeping platform structure of the bed has been divided into two longitudinal sections

and three lateral sections, the middle of which transforms into a wheelchair. The division of the sleeping platform structure into separate sections constitutes the same functional problem as described in connection of the previous picture, Figure 44. The backrest plate and foot plates of the bed can be adjusted upward when the user is in a lying position on the wheelchair section of the bed. The electrically operated wheelchair structure is laterally moved out of the other structural sections of the bed structure, after which the foot and backrest plates are adjusted to the seating position. The adjustable bed solutions in the pictures Fig. 44 and Fig.45 are suitable for use in, for example, nursing homes and rehabilitation centers and home care, where there is no need for more versatile adjustments of the bed.

Fig.46, Fig.47 and Fig.48

[0086] The axonometric pictures show the bed solutions in which the wheelchairs are connected into the sleeping platform structures through the foot end of the beds. The beds consist of two separate main structural parts - the U-shaped sleeping platform structures and the wheelchair structures positioned deep inside them. The solid structured bed legs of the bed solutions in the figures Fig.46 and Fig.48 and the height-adjustable pedestal structure of the bed solution in the figure Fig.47 are placed under the sleeping platform structures of the beds. The need for space required for the wheelchairs positioned between the solid structured bed legs and the height adjustable pedestal structure underneath the bed-sides of the sleeping platform structures on the beds, has led to the U-shape of sleeping platform structures of these bed solutions. The sleeping platforms of the beds are thus divided into three longitudinal structural and functional sections - to the sections located on the sides of the sleeping platform structures and to the middle section in between them where the wheelchairs are positioned.

[0087] When the wheelchair structures are adjusted to the reclining position they form the sleeping platforms together with the above-mentioned side sections of the beds. However, the sitting position in these beds is possible only while sitting on the seat plate of the wheelchair in the middle section of the sleeping platform structure. The location of the body of the bed user may change on the sleeping platform surface during a treatment operation or when the user has been turned to the side position. When moving out of bed or from the reclining position to a sitting position, the bed user's body must be in the middle section of the sleeping structure of the bed, where the wheelchair is located. If the user of the bed can not move his or her body alone, the action requires the presence of the caregiver. The adjustment properties of these bed solutions are very limited because of their structural and functional solutions. In the bed solution in the figure Fig.47 the sleeping platform structure can be adjusted to the treatment height. A mechanically adjustable backrest plate, such as commonly used in the conventional beds,

is attached to the sleeping platform structure of the bed solution in the figure Fig.48. A separate backrest plate is attached to the wheelchair structure when it is removed from the bed structure. Among the above mentioned bed solutions and the adjustable bed solution of the present invention, the common feature is the moving to and out of the bed by means of a wheelchair - in the present invention by means of the seat module (3a) - through the foot end of the bed. There are no other similarities. The above mentioned bed solutions are structurally and functionally completely different from the adjustable bed solution of the invention.

Reference numbers

[0088]

- 1 Sleeping platform frame structure
- 2 Support framework for the backrest plate of the sleeping platform frame structure
- 3a Seat module
- 3b Frame structure of the seat module
- 4 Adjustable pedestal structure
- 5 Foot structure of the pedestal
- 6 Lever arms of the pedestal
- 7 Rotation cylinders of the pedestal
- 8 Cover plates of the pedestal
- 9 Sleeping platform support lever arms of the pedestal
- 10 Support plate profiles of the sleeping platform frame structure.
- 11 Rotation axle of the backrest plate of the seat module
- 12 Rotation axle of the foot plates of the seat module
- 13 Rotation axle of the armrests
- 14 Upper backrest plate attached to the support framework for the backrest plate
- 15 Backrest plate of the seat module
- 16 Seat plate of the seat module
- 17 Foot plate part 1 of the seat module
- 18 Foot plate part 2 of the seat module
- 19 Headboard of the sleeping platform structure
- 20 Adjustable armrest
- 21 Locking fitting of the backrest plate of the seat module in the stand-up position of the bed attached to the sleeping platform frame structure
- 22 Front beam of the sleeping platform frame structure with the anchoring locking mechanism for the seat module
- 23 Locking fitting of the backrest plate of the seat module in the stand-up position of the bed
- 24 Adjusting actuator of the armrests of the seat module
- 25 Toothed belt mechanism of the armrests of the seat module
- 26 Support fitting of the headrest of the seat module
- 27 Charging and wiring plug of the seat module
- 28 Optical position sensor of the seat module

29	Mattress	58	Actuator for the lifting wheel of the lateral tilt adjustment of the bed
30a	Freely rotating wheel	59	Attention light of the tilt function of the bed structure
30b	Lockable wheel	5	60 Control panel of the adjustments of the bed
30c	Lifting wheels of the lateral tilt adjustment of the bed	61	Display panel of the operating codes of the adjusting actuators of the pedestal structure and the electrical connection plug of the bed
31	Motor and drive wheel bogie of the seat module	62	Adjustable bed railing
32	Direction of the lateral movement of the drive wheels of the seat module	10	63 Telescopic part of the bed railing structure
33 a	Seat module support profiles of the anchoring mechanism	64	Protection plate surface of the bed railing
33b	Guide bearings of the seat module support profiles	65	Support profile of the bed railing
34	Anchoring locking mechanism for the seat module, locking fitting open	66	Locking switch of the bed railing
35	Anchoring locking mechanism for the seat module, locking fitting closed	67	Adjustment movement of the bed railing
36	Turning motor of the motor and drive wheel bogie	15	68 Adjustment movement of the telescopic part of the bed railing structure
37	Toothed belt mechanism	69	High backrest plate of the seat module
38	Locking plate part of the backrest plate of the seat module	70	Cover plate on the underside of the sleeping platform frame structure
39	Opening in the back edge of the seat module frame structure for the movement of the locking plate part of the backrest plate	20	71 Safety sensor placed in the frame structure of the seat module
40	Actuator of the locking mechanism	72	Safety sensors of the sleeping platform frame structure and the support framework for the backrest plate of the sleeping platform frame structure
41	Rotation movement of the armrest of the seat module to the operating position	25	73 Locking plate of the backrest plate locking mechanism of the seat seat module
42	Operating switch of the seat module	74	Push lever of the backrest plate locking mechanism of the seat seat module
43	Locking mechanism of the backrest plate of the seat module	30	
44a	Sliding rail of the backrest plate locking mechanism which moves the locking plate part of the backrest plate of the seat module		
44b	Sliding rails connecting the foot plate parts 1 and 2 of the seat module		
45	Actuator of the adjustment of the tilt angle of the foot plates of the seat module	35	
46	Actuator of the length adjustment of the foot plate assembly of the seat module		
47	Longitudinal adjustment of the foot plate part 2 of the seat module	40	
48	Adjustment movement of the backrest locking mechanism of the seat module		
49	Removable headrest of the seat module		
50	Adjusting actuator of the support framework for the backrest plate of the sleeping platform frame structure	45	
51	Scissor lift mechanism of the support framework for the backrest plate of the sleeping platform frame structure		
52	Anchoring support and guide profile of the frame structure of the seat module	50	
53	Control unit of the pedestal structure		
54	Control unit of the sleeping platform structure and the seat module		
55	Control unit of the seat module	55	
56	Wheel of the adjustable pedestal structure		
57	Lifting wheel mechanism of the lateral tilt adjustment of the bed		

Claims

1. An adjustable bed solution intended for use in care and bed wards in hospitals, health centers, nursing homes, rehabilitation centers and homes, wherein the bed structure consists of the sleeping platform frame structure (1) and the height adjustable support framework for the backrest plate of the seat module (2) attached to it and of the removable seat module (3a) integrated into the foot end of the bed structure, which sleeping platform frame structure (1) is supported by the adjustable pedestal structure (4) placed under the sleeping platform frame structure (1) that allows the adjustments of the bed structure, **characterized in that** the adjustable pedestal structure (4) is used to adjust the height position of the sleeping platform structure (1) and the longitudinal tilt position of the sleeping platform frame structure (1), and structural solution of the adjustable pedestal structure (4) consists of the two parallel lever arm (6) assemblies which are connected to each other through the rotation cylinders (7) equipped with adjusting actuators that move the lever arms (6), and which lever arm (6) assemblies and the rotation cylinders (7) are supported by a U-shaped foot structure of the pedestal (5).

2. An adjustable bed solution according to claim 1, **characterized in that** at the foot end of the sleeping platform frame structure (1) where the frame structure of the seat module (3b) can be anchored is the anchoring mechanism for the seat module (33) and the corresponding anchoring support and guide profiles (52) are placed on the sides of the frame structure of the seat module. 5
3. An adjustable bed solution according to any one of the preceding claims, **characterized in that** between the anchoring mechanisms for the seat module (33) of the sleeping platform frame structure (1) is the front beam of the sleeping platform frame structure (22) where the anchoring locking mechanism (34,35) for the frame structure of the seat module (3b) is placed. 10 15
4. An adjustable bed solution according to any one of the preceding claims, **characterized in that** the backrest plate (15), seat plate (16) and foot plates (17 and 18) of the seat module (3a) together with the sleeping platform frame structure (1) and the support framework for the backrest plate of the seat module (2) attached to it form the sleeping platform structure of the bed. 20 25
5. An adjustable bed solution according to any one of the preceding claims, **characterized in that** under the frame structure of the seat module (3b) is the motor and drive wheel bogie of the seat module (31) which allows the lateral movement of the seat module. 30
6. An adjustable bed solution according to any one of the preceding claims, **characterized in that** the foot plates of the seat module (17 and 18) are height adjustable and adjustable in the longitudinal direction of the sleeping platform structure. 35 40
7. An adjustable bed solution according to any one of the preceding claims, **characterized in that** the adjustable armrests of the seat module (20) are attached to the backrest plate of the seat module (15) and the operating switch of the seat module (42) is connected to one of them. 45

Patentansprüche

1. Anpassbare Bettlösung zur Verwendung in Pflege- und Bettabteilungen in Krankenhäusern, Gesundheitszentren, Pflegeheimen, Rehabilitationszentren und Heimen, wobei die Bettstruktur aus der Schlafplattform-Rahmenstruktur (1) und dem höhenanpassbaren Tragrahmen für die Rückenlehnenplatte des daran befestigten Sitzmoduls (2) und des abnehmbaren Sitzmoduls (3a), das in das Fußende der 50

Bettstruktur integriert ist, besteht, wobei die Schlafplattform-Rahmenstruktur (1) von der anpassbaren Sockelstruktur (4) getragen wird, die unter der Schlafplattform-Rahmenstruktur (1) angeordnet ist und die Anpassungen der Bettstruktur erlaubt, **dadurch gekennzeichnet, dass** die anpassbare Sockelstruktur (4) verwendet wird, um die Höhenposition der Schlafplattformstruktur (1) und die Längsneigungsposition der Schlafplattform-Rahmenstruktur (1) anzupassen, und eine strukturelle Lösung der anpassbaren Sockelstruktur (4) aus zwei parallelen Hebelarmanordnungen (6) besteht, die miteinander durch die Rotationszylinder (7) verbunden sind, die mit Anpassungsaktuatoren ausgestattet sind, die die Hebelarme (6) bewegen, und wobei die Hebelarmanordnungen (6) und die Rotationszylinder (7) durch eine U-förmige Fußstruktur des Sockels (5) getragen werden.

2. Anpassbare Bettlösung nach Anspruch 1, **dadurch gekennzeichnet, dass** am Fußende der Schlafplattform-Rahmenstruktur (1), wo die Rahmenstruktur des Sitzmoduls (3b) verankert werden kann, der Verankerungsmechanismus für das Sitzmodul (33) ist und die entsprechenden Verankerungsträger- und Führungsprofile (52) an den Seiten der Rahmenstruktur des Sitzmoduls platziert sind.
3. Anpassbare Bettlösung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sich zwischen den Verankerungsmechanismen für das Sitzmodul (33) der Schlafplattform-Rahmenstruktur (1) der vordere Balken der Schlafplattform-Rahmenstruktur (22) befindet, wo der Verankerungs-Verriegelungsmechanismus (34, 35) für die Rahmenstruktur des Sitzmoduls (3b) platziert ist.
4. Anpassbare Bettlösung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Rückenlehnenplatte (15), die Sitzplatte (16) und die Fußplatten (17 und 18) des Sitzmoduls (3a) zusammen mit der Schlafplattform-Rahmenstruktur (1) und dem daran angebrachten Tragrahmen für die Rückenlehnenplatte des Sitzmoduls (2) die Schlafplattformstruktur des Bettes bilden.
5. Anpassbare Bettlösung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sich unter der Rahmenstruktur des Sitzmoduls (3b) das Motor- und Antriebsrad-Drehgestell des Sitzmoduls (31) befindet, das die laterale Bewegung des Sitzmoduls erlaubt.
6. Anpassbare Bettlösung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Fußplatten des Sitzmoduls (17 und 18) höhenanpassbar und in der Längsrichtung der Schlafplattformstruktur anpassbar sind.

7. Anpassbare Bettlösung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die anpassbaren Armlehnen des Sitzmoduls (20) an der Rückenlehnenplatte des Sitzmoduls (15) angebracht sind und der Bedienschalter des Sitzmoduls (42) mit einer von ihnen verbunden ist.

Revendications

1. Solution de lit réglable pour une utilisation dans des salles de soins et de lits dans des hôpitaux, des centres de santé, des maisons de soins infirmiers, des centres de rééducation et des maisons, dans laquelle la structure de lit est constituée de la structure de cadre de plateforme de couchage (1) et de l'ossature de support réglable en hauteur pour la plaque de dossier du module de siège (2) qui y est fixé et du module de siège amovible (3a) intégré dans l'extrémité pied de la structure de lit, laquelle structure de cadre de plateforme de couchage (1) est supportée par la structure de socle réglable (4) placée sous la structure de cadre de plateforme de couchage (1) qui permet les réglages de la structure de lit, **caractérisée en ce que** la structure de socle réglable (4) est utilisée pour régler la position en hauteur de la structure de plateforme de couchage (1) et la position d'inclinaison longitudinale de la structure de cadre de plateforme de couchage (1), et la solution structurelle de la structure de socle réglable (4) est constituée de deux ensembles de bras de levier (6) parallèles qui sont reliés l'un à l'autre par l'intermédiaire des cylindres de rotation (7) équipés d'actionneurs de réglage qui déplacent les bras de levier (6), et lesquels ensembles de bras de levier (6) et les cylindres de rotation (7) sont supportés par une structure de pied en forme de U du socle (5).
2. Solution de lit réglable selon la revendication 1, **caractérisée en ce que**, au niveau de l'extrémité pied de la structure de cadre de plateforme de couchage (1) où la structure de cadre du module de siège (3b) peut être ancrée, se trouve le mécanisme d'ancrage pour le module de siège (33) et les profilés de support et de guidage d'ancrage correspondants (52) sont placés sur les côtés de la structure de cadre du module de siège.
3. Solution de lit réglable selon l'une quelconque des revendications précédentes, **caractérisée en ce que**, entre les mécanismes d'ancrage pour le module de siège (33) de la structure de cadre de plateforme de couchage (1) se trouve la poutre avant de la structure de cadre de plateforme de couchage (22) où est placé le mécanisme de verrouillage d'ancrage (34, 35) pour la structure de cadre du module de siège (3b).

4. Solution de lit réglable selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la plaque de dossier (15), la plaque de siège (16) et les plaques de pieds (17 et 18) du module de siège (3a) ainsi que la structure de cadre de plateforme de couchage (1) et l'ossature de support pour la plaque de dossier du module de siège (2) qui y est fixé forment la structure de plateforme de couchage du lit.
5. Solution de lit réglable selon l'une quelconque des revendications précédentes, **caractérisée en ce que** sous la structure de cadre du module de siège (3b) se trouve le bogie moteur et de roue motrice du module de siège (31) qui permet le mouvement latéral du module de siège.
6. Solution de lit réglable selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les plaques de pieds du module de siège (17 et 18) sont réglables en hauteur et réglables dans la direction longitudinale de la structure de plateforme de couchage.
7. Solution de lit réglable selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les accoudoirs réglables du module de siège (20) sont fixés à la plaque de dossier du module de siège (15) et le commutateur de commande du module de siège (42) est relié à l'un d'eux.

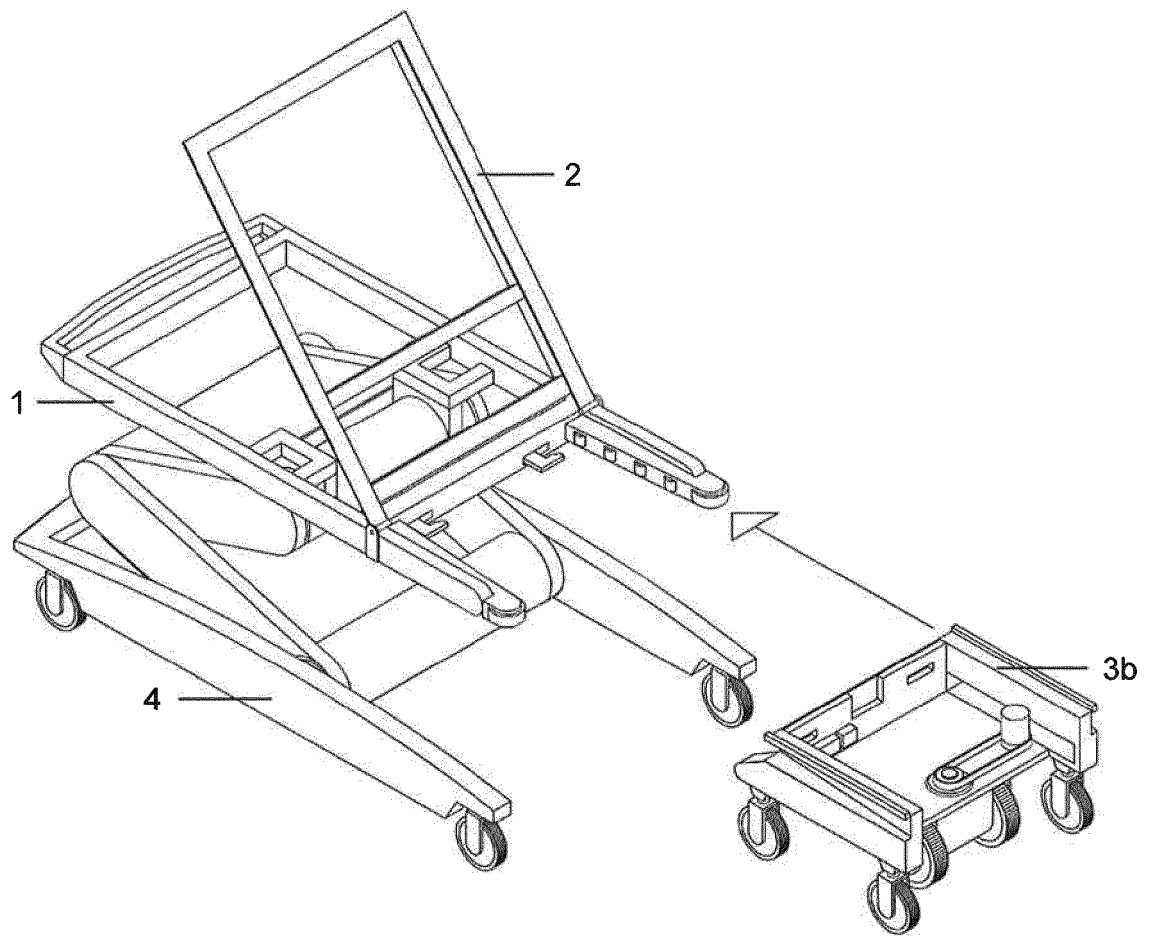


Fig.1

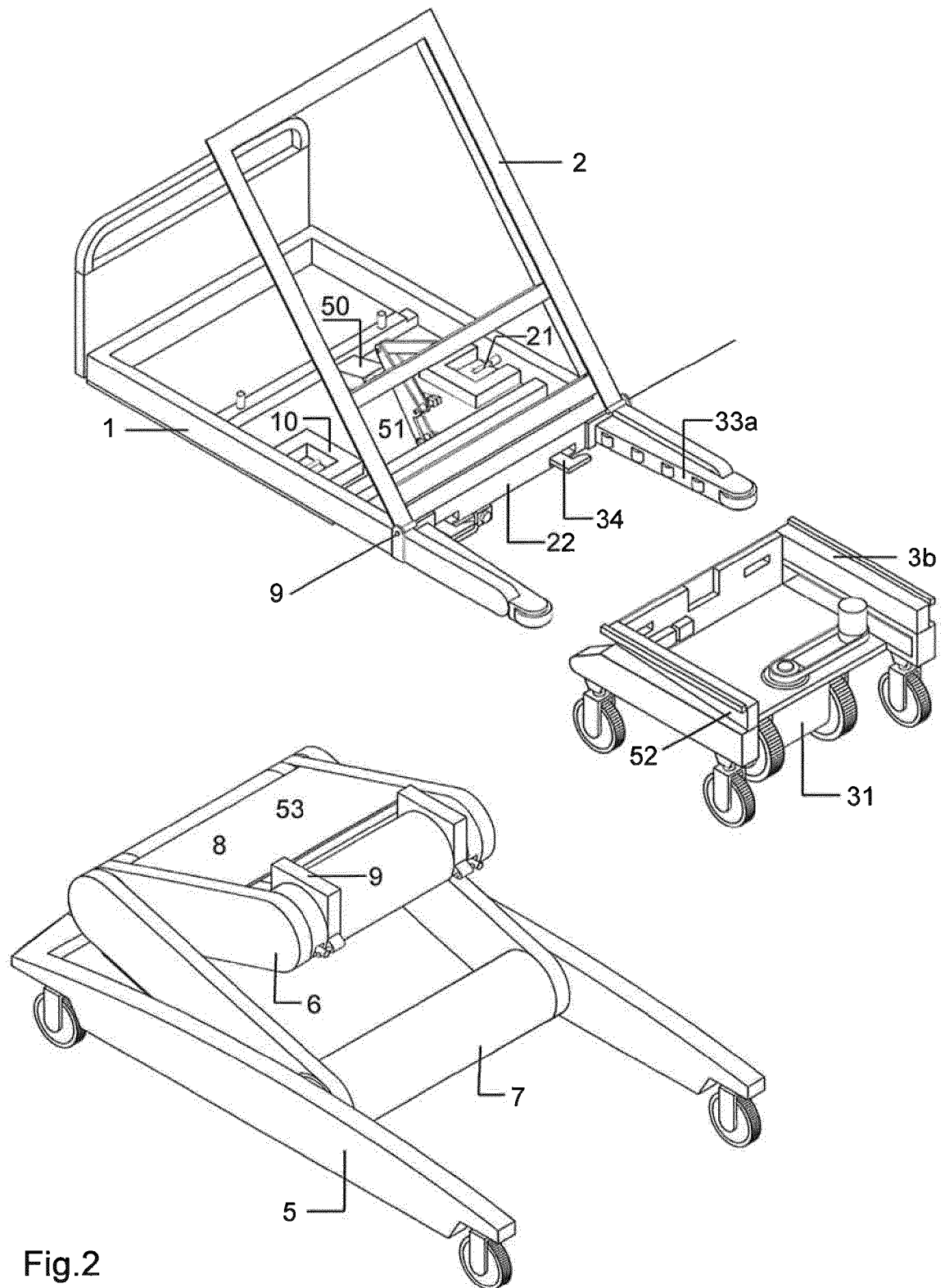


Fig.2

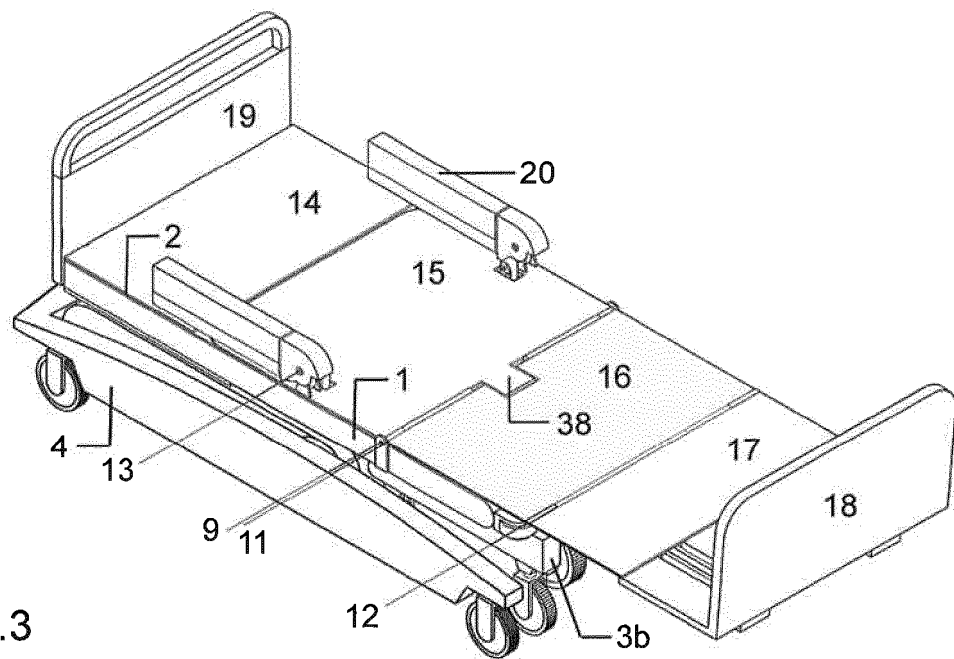


Fig.3

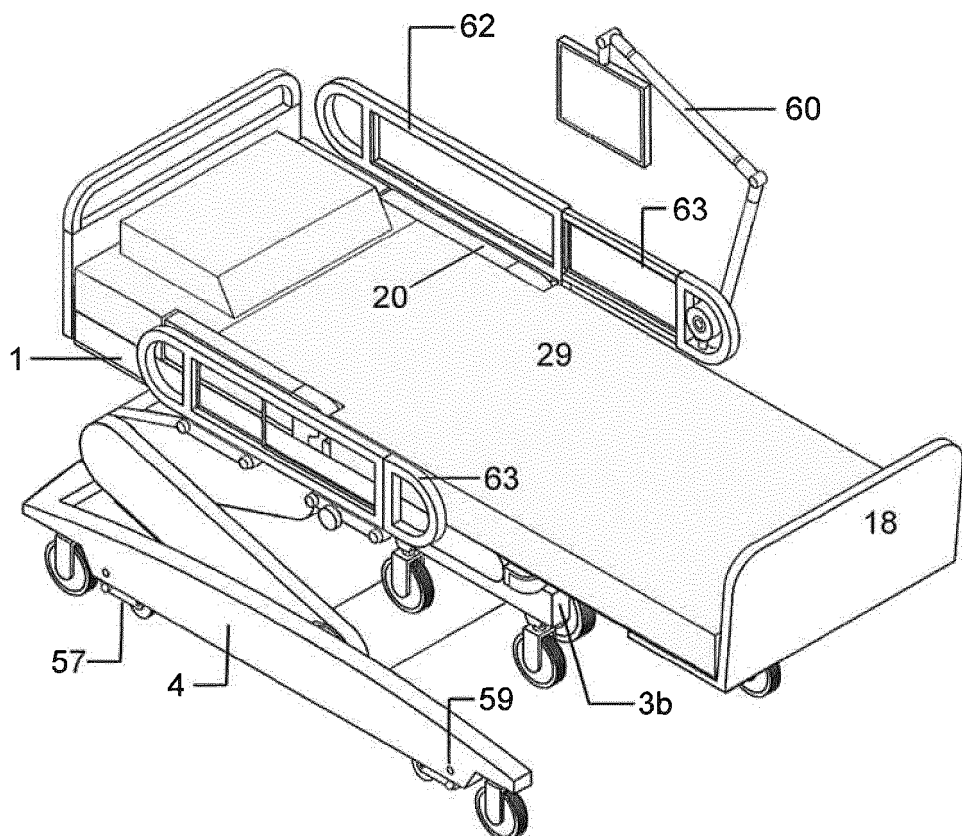


Fig.4

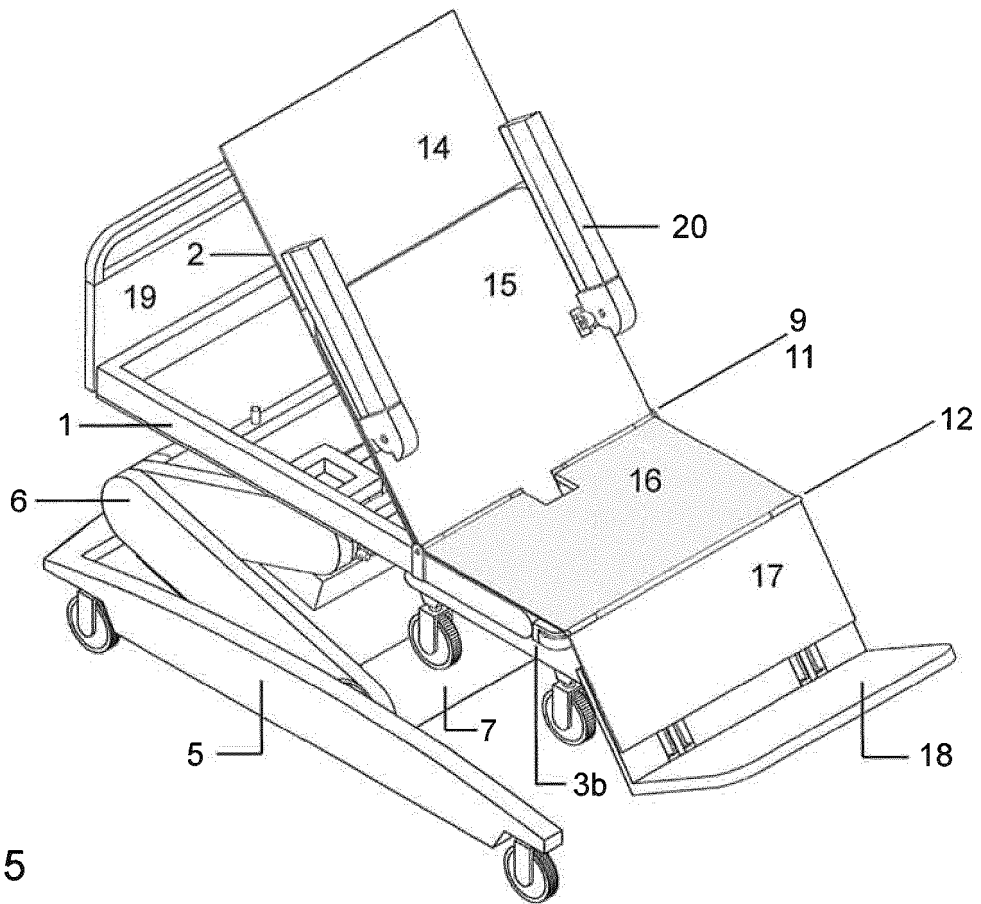


Fig.5

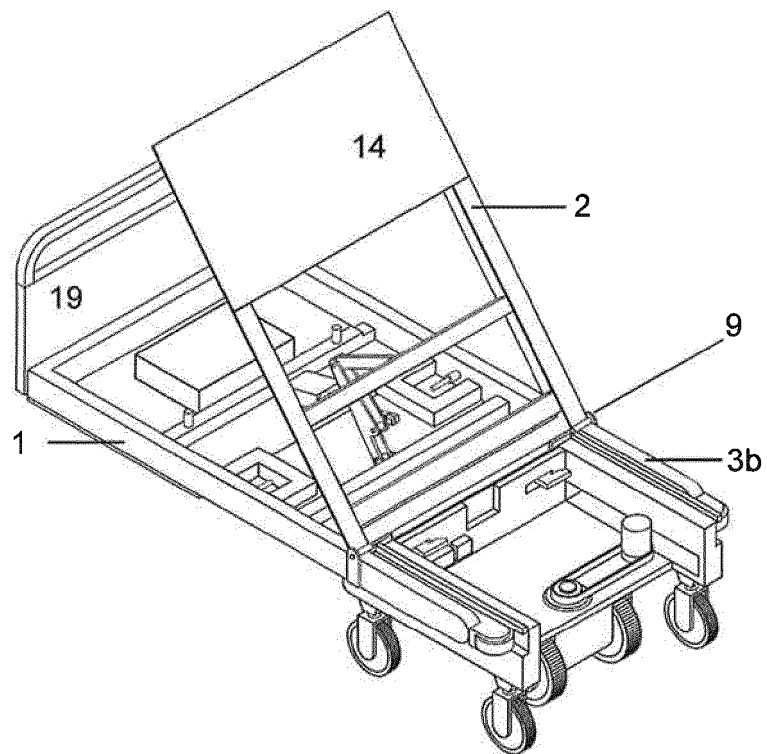


Fig.6

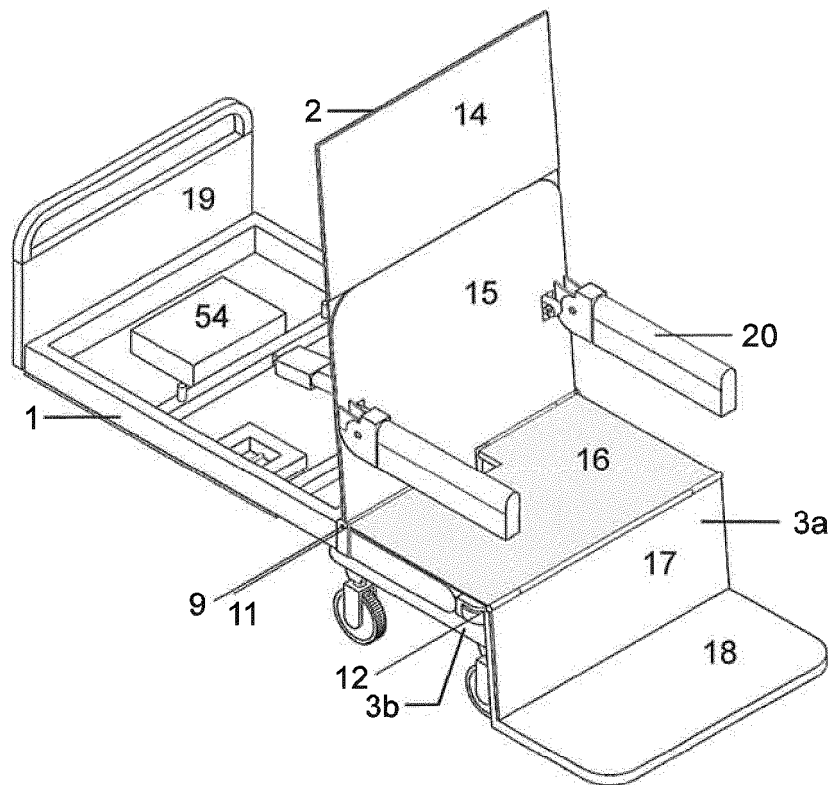


Fig.7

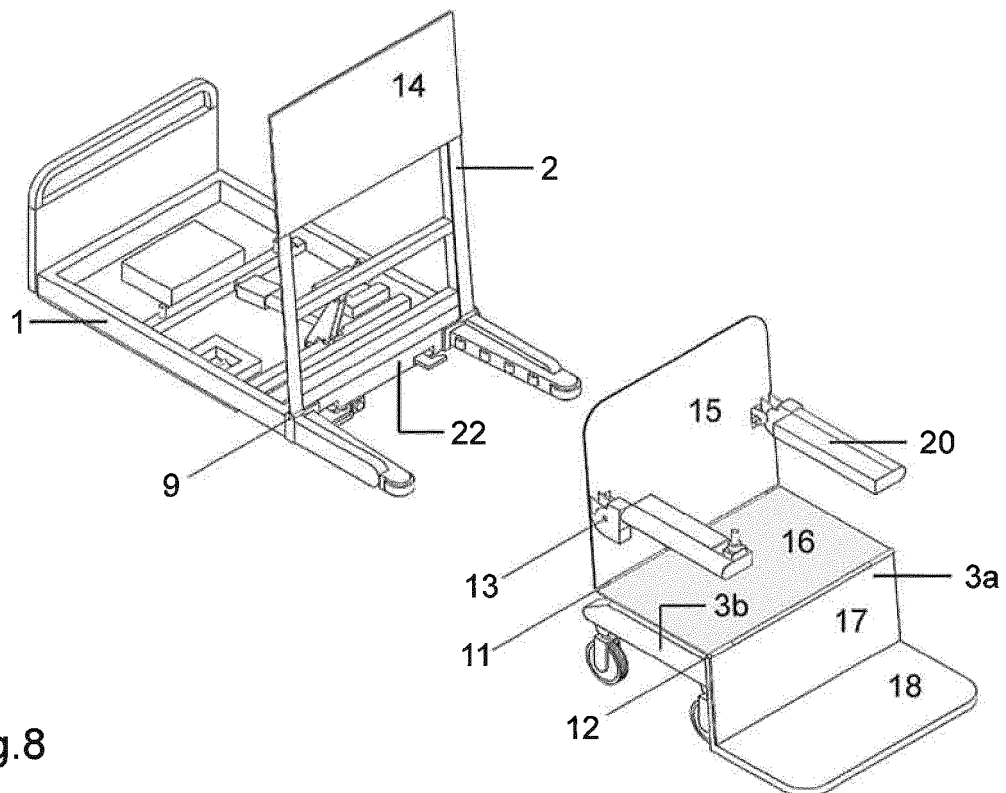


Fig.8

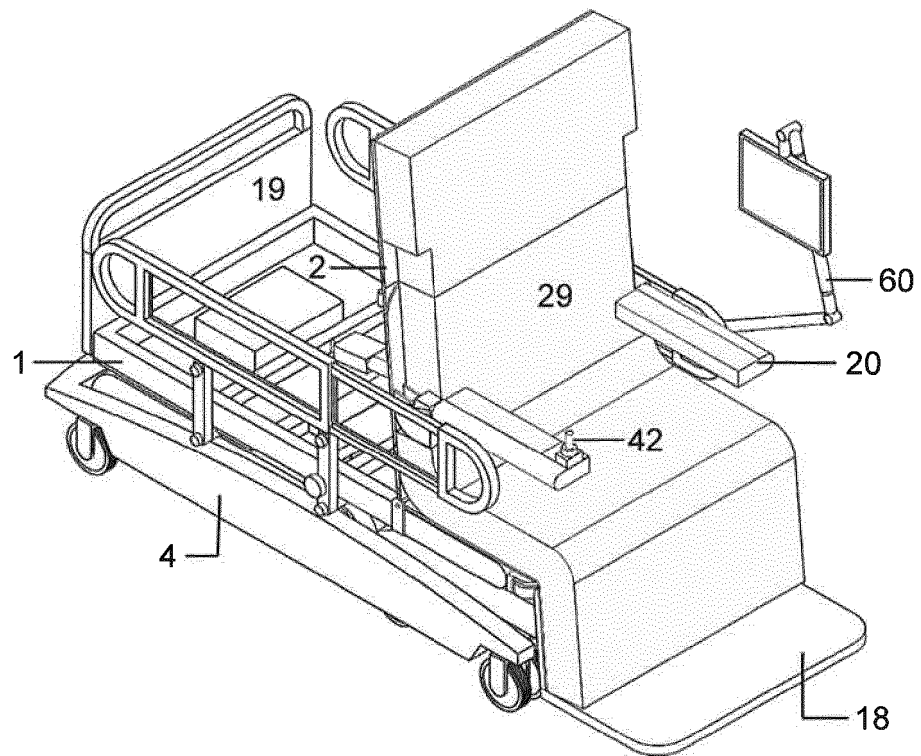


Fig. 9

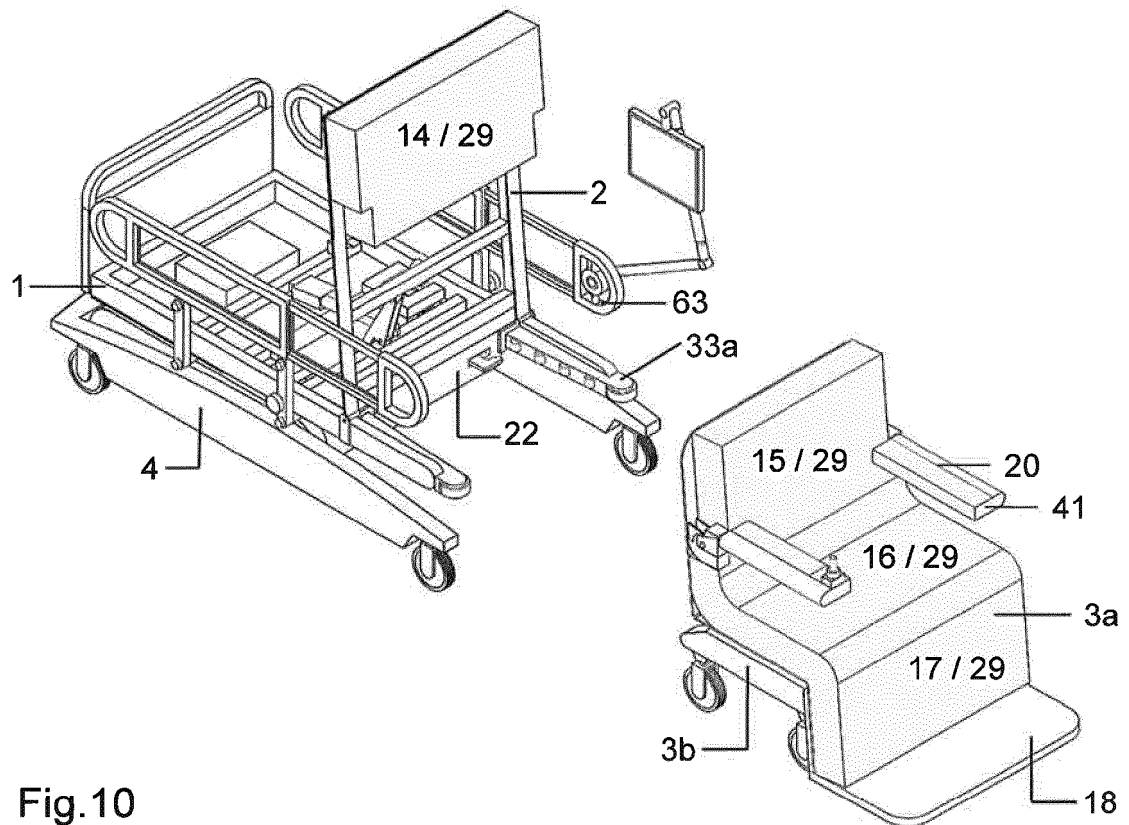


Fig. 10

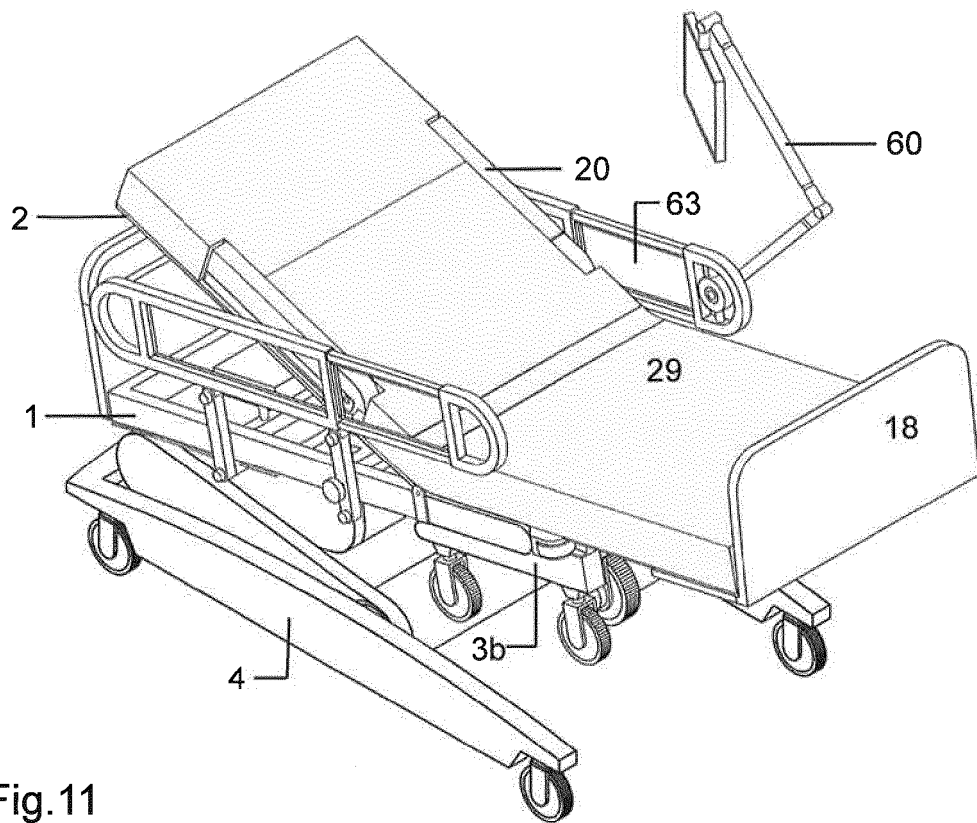


Fig. 11

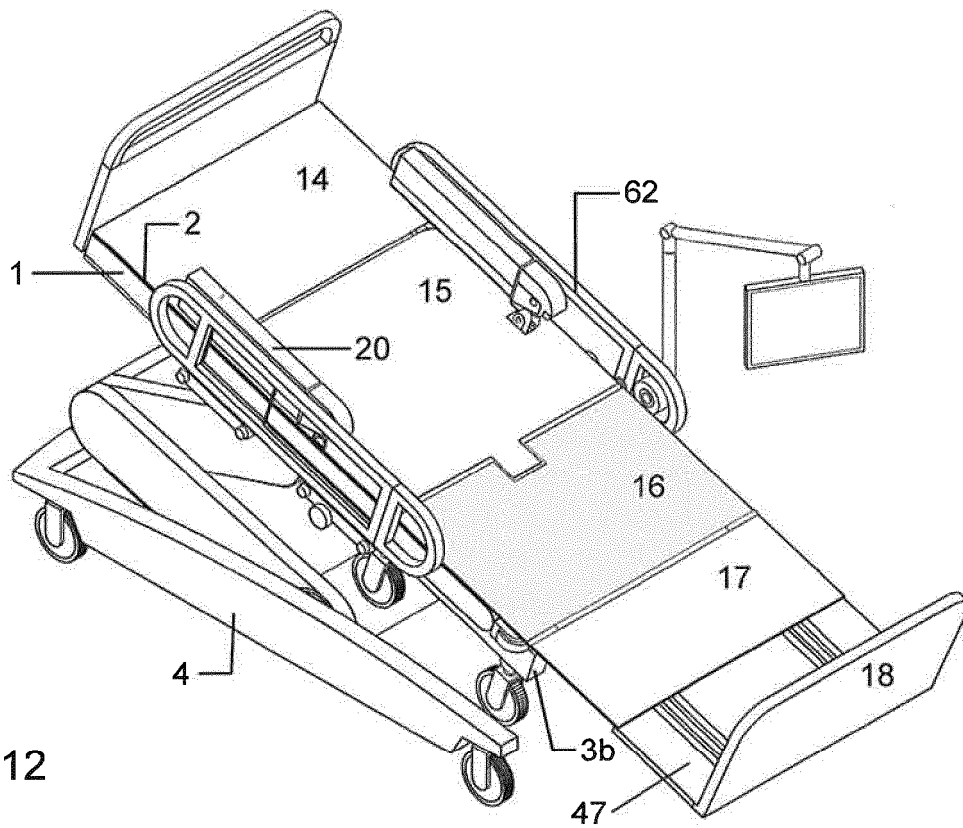


Fig. 12

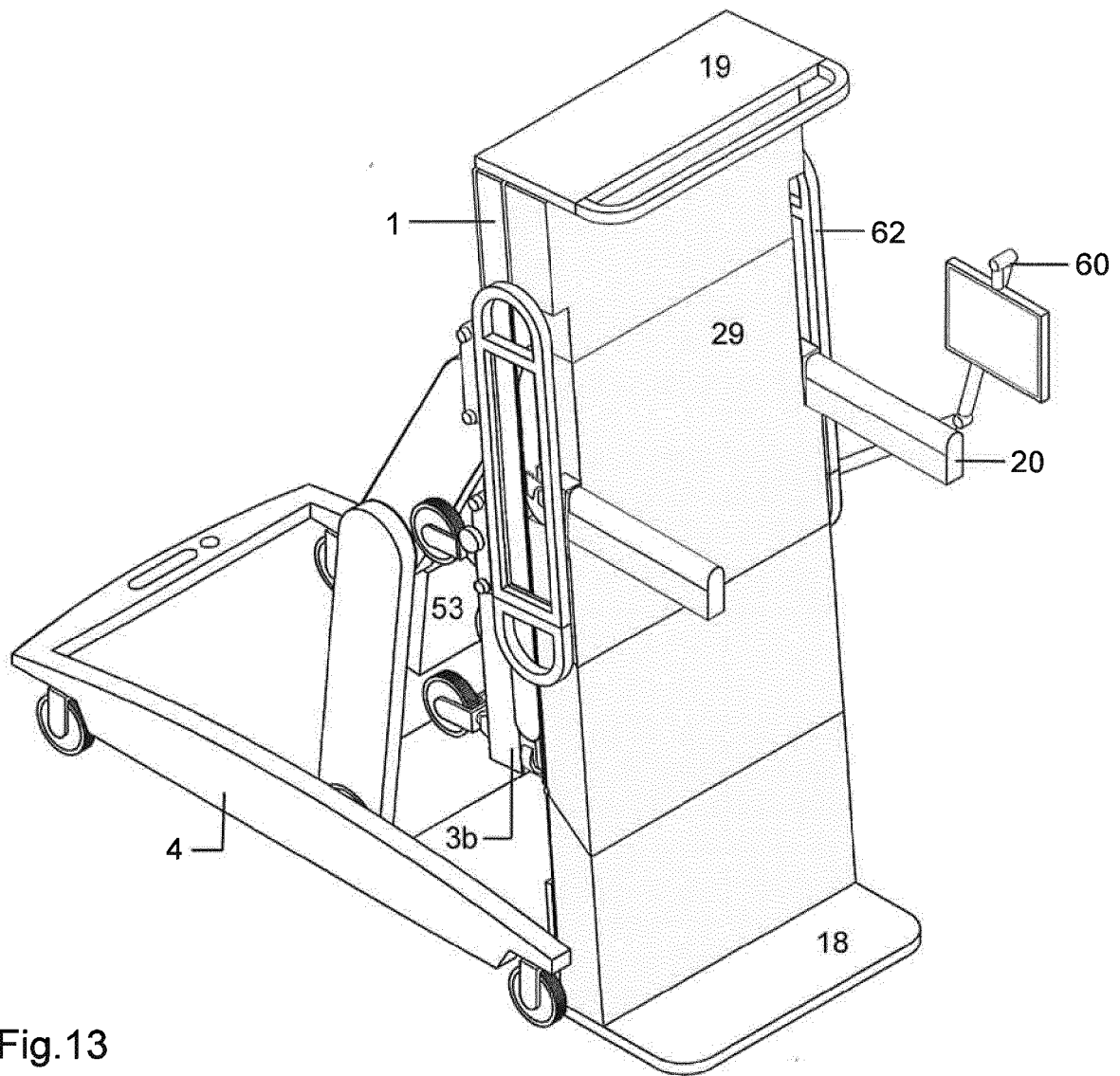


Fig.13

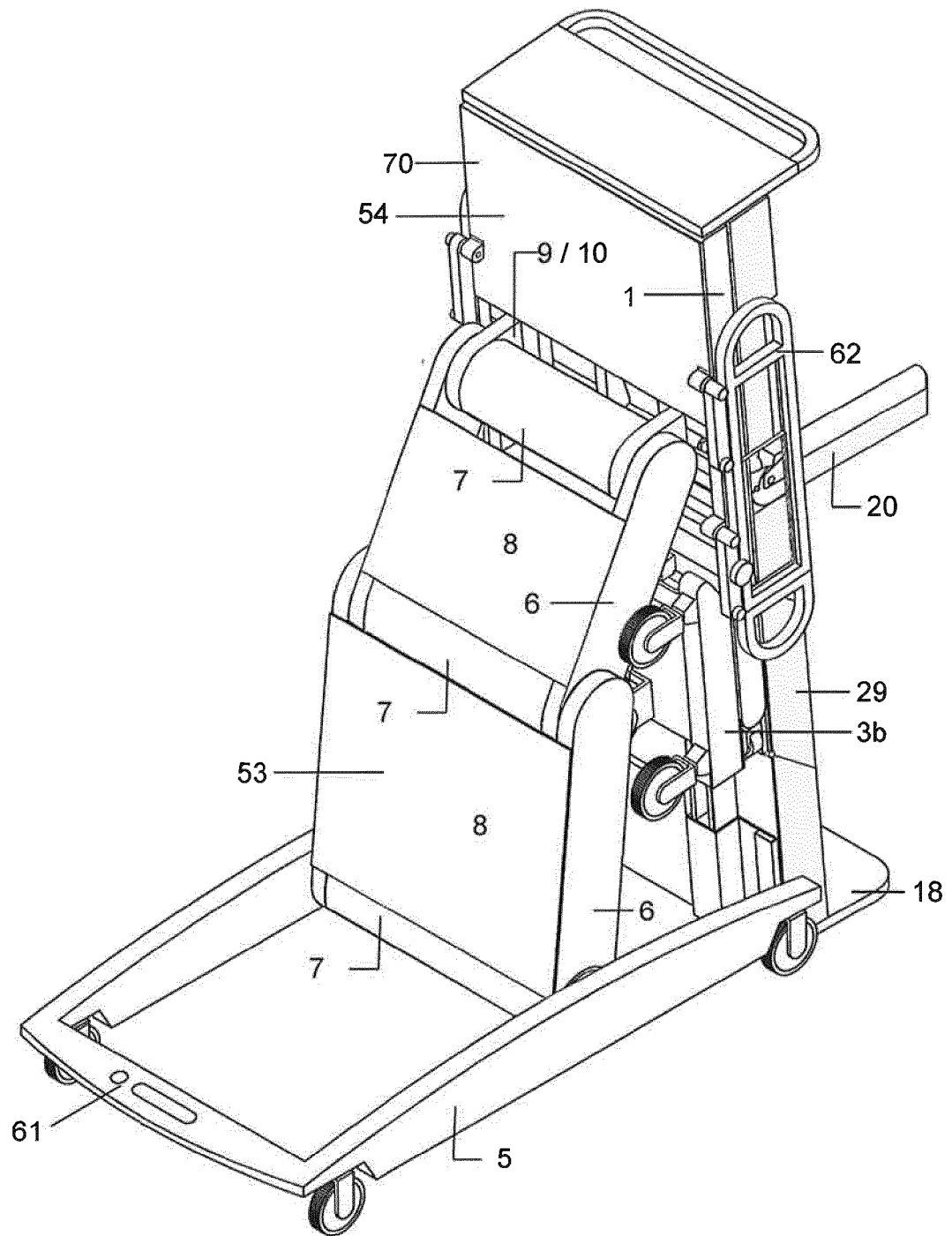


Fig.14

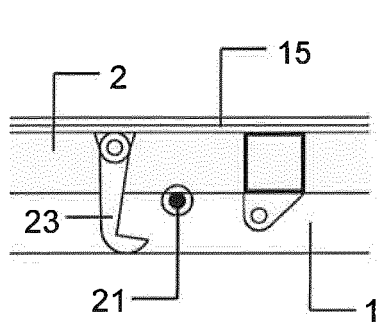
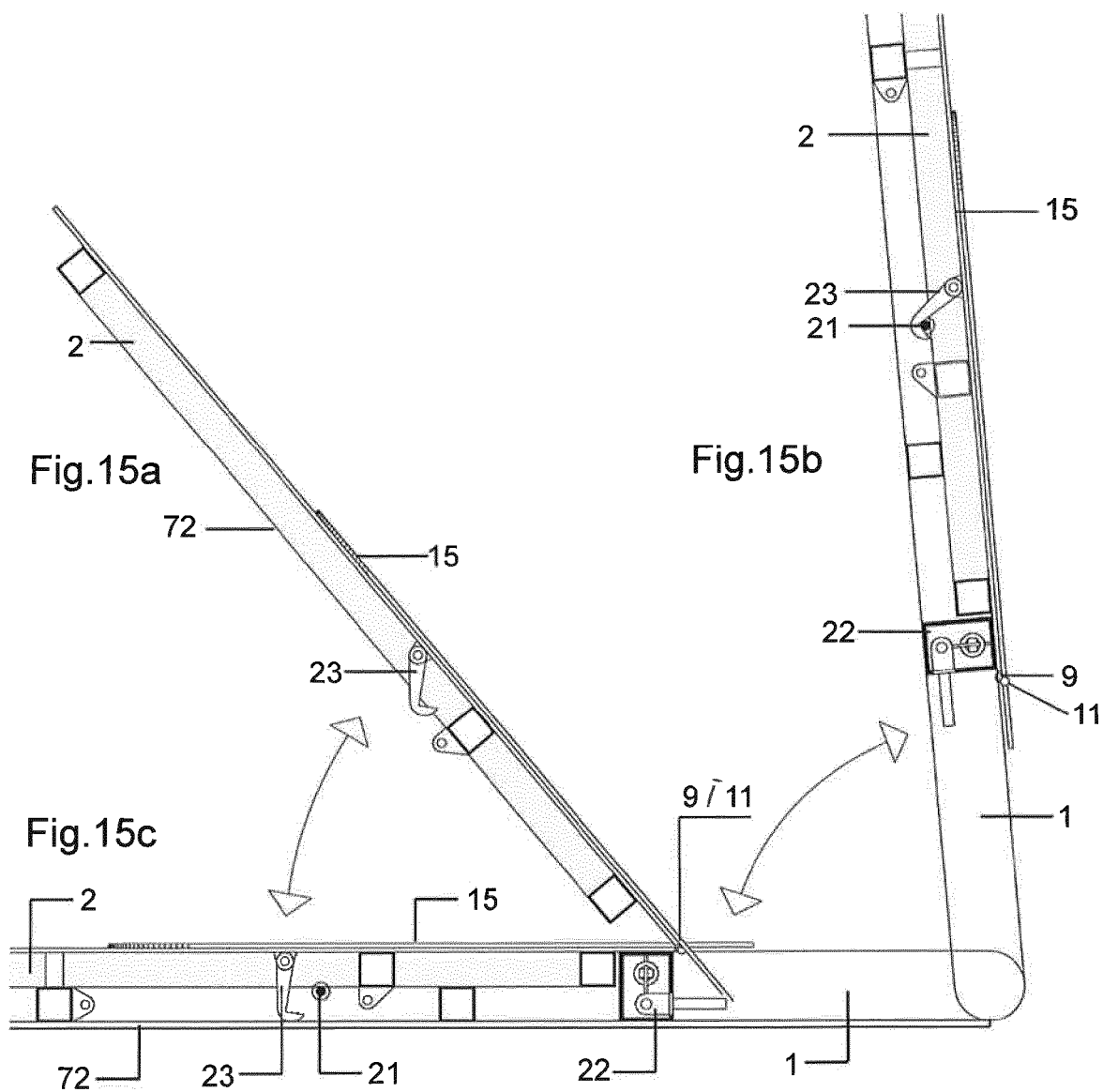
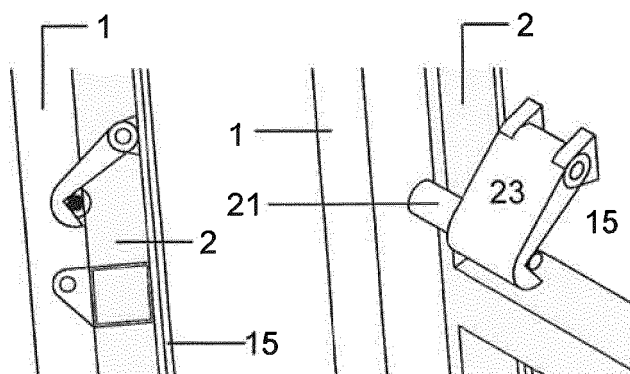


Fig.16



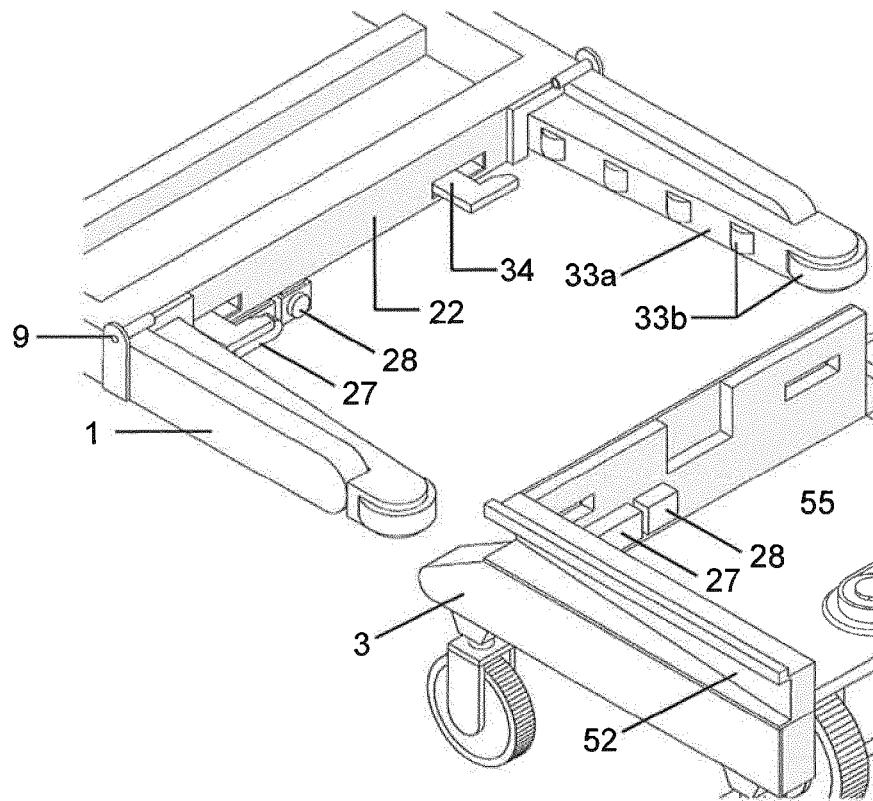


Fig.17

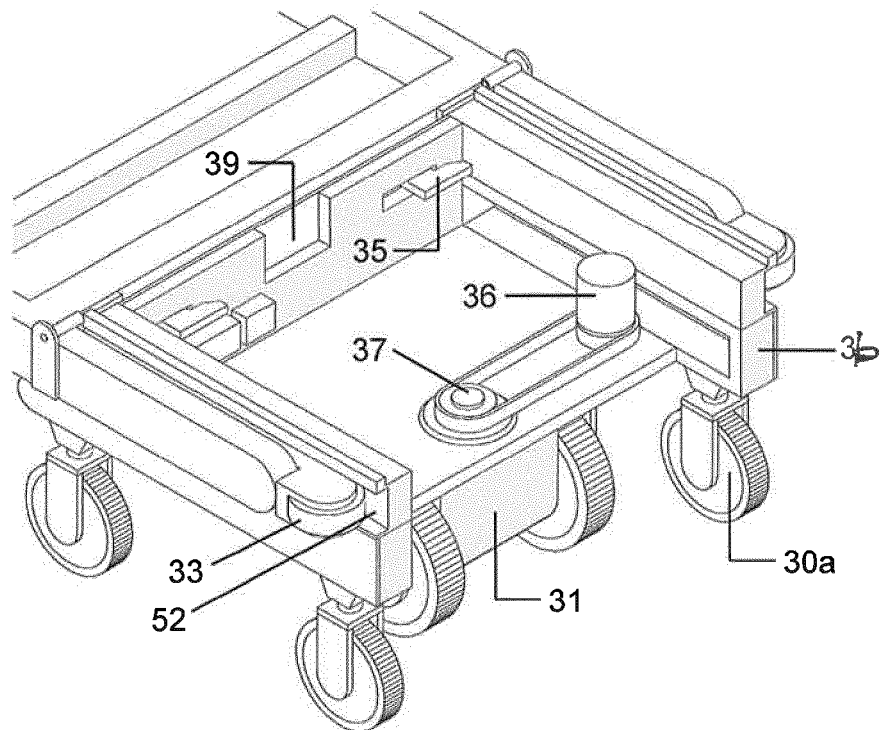


Fig.18

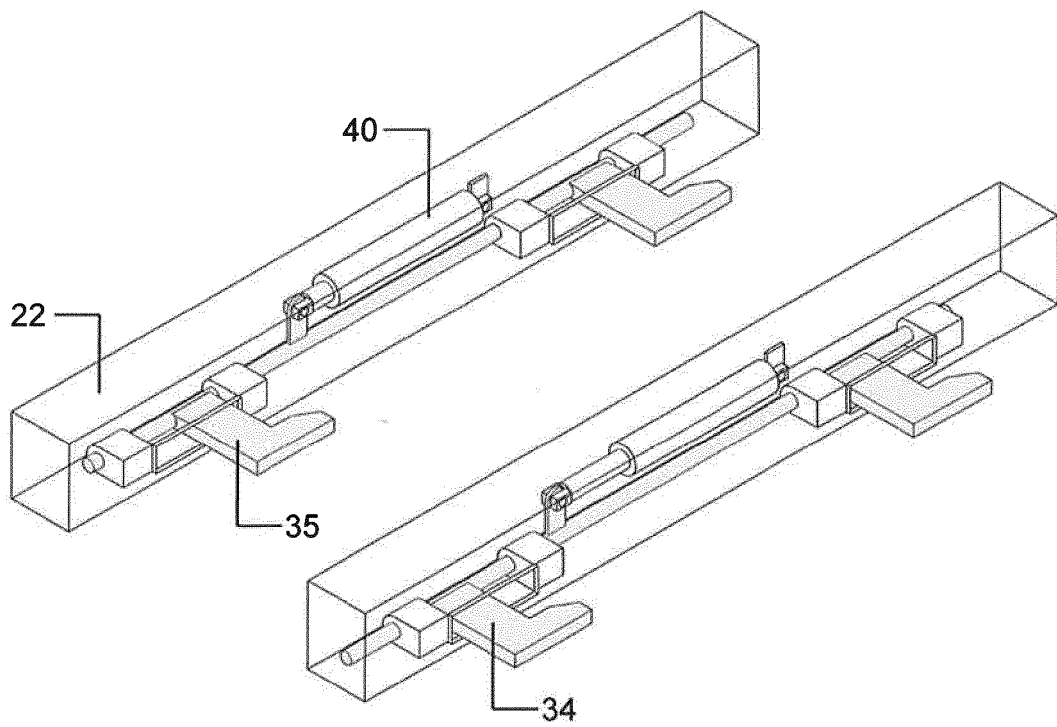


Fig.19

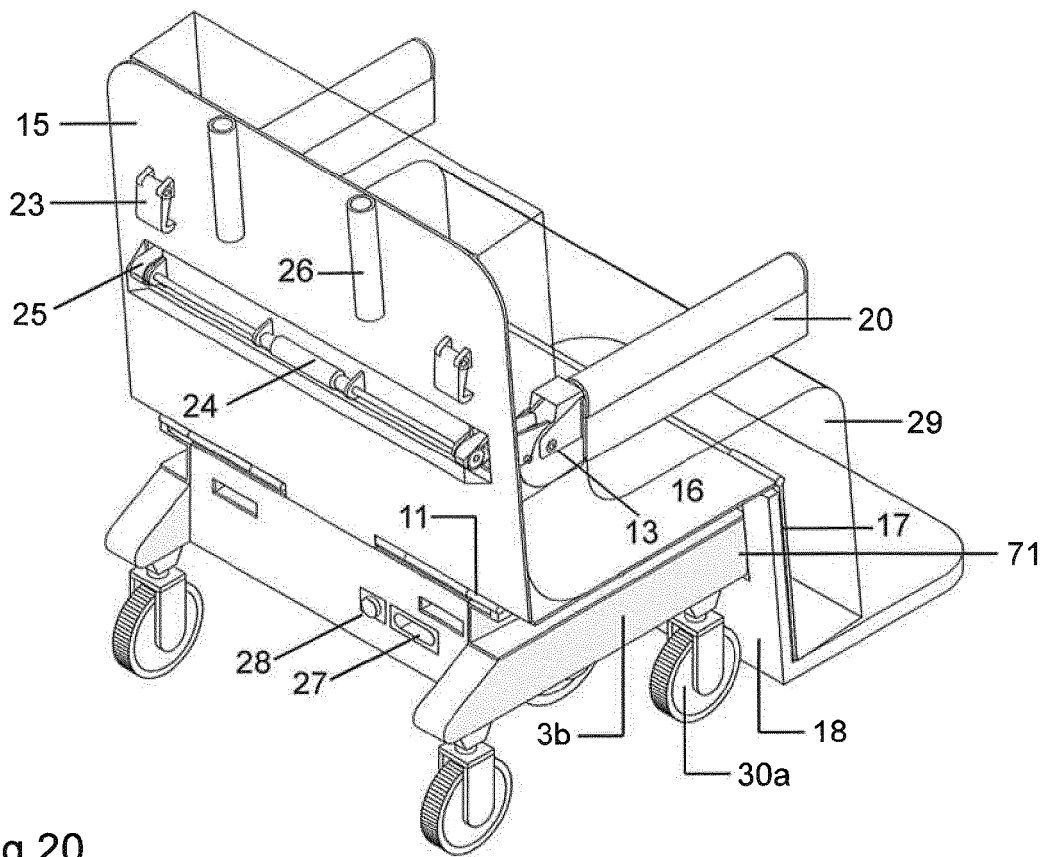


Fig. 20

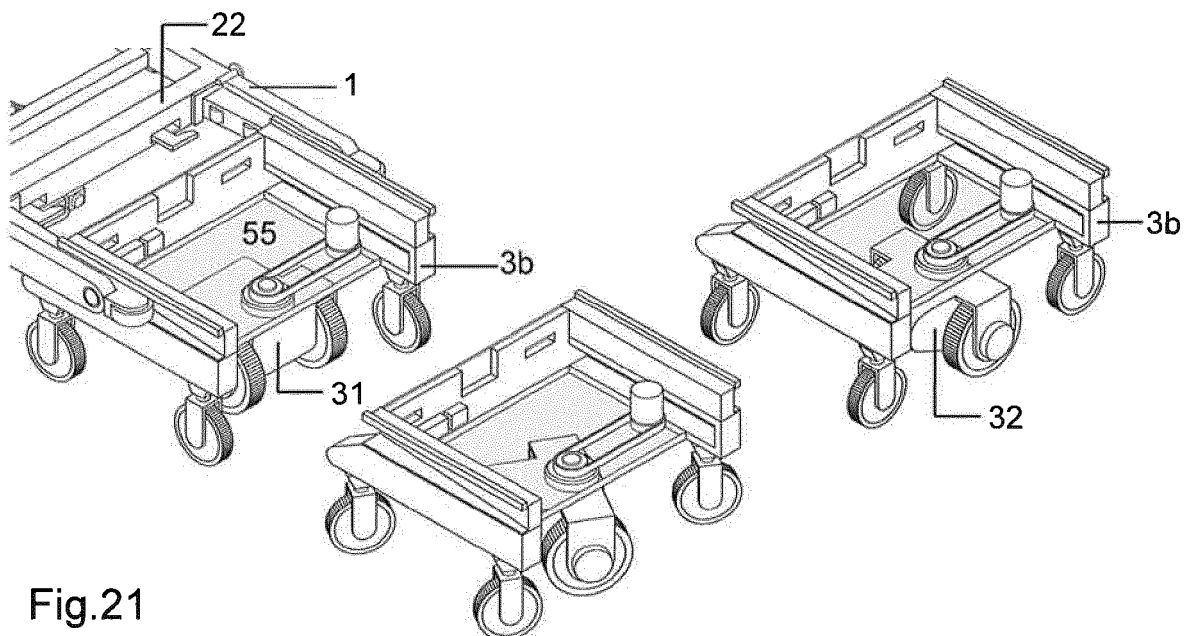


Fig. 21

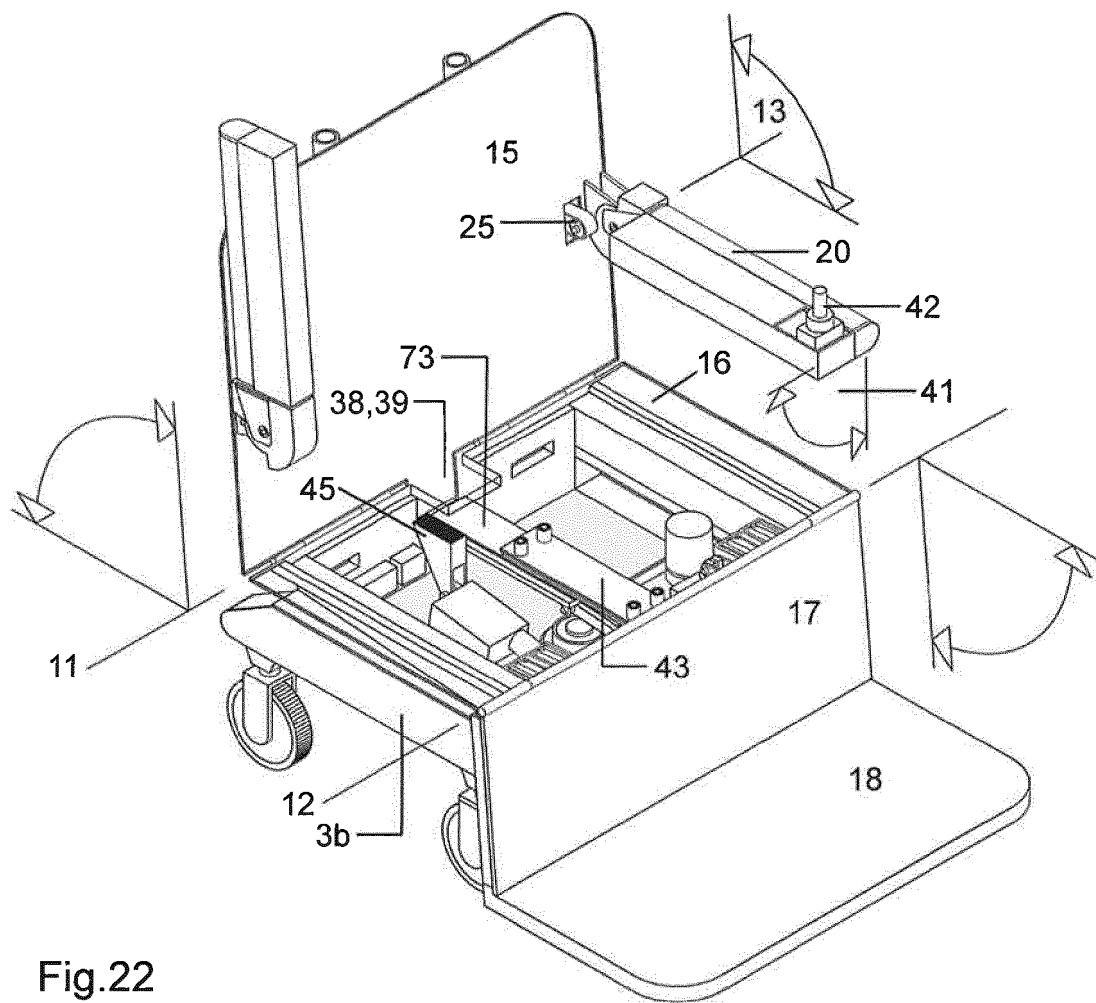


Fig.22

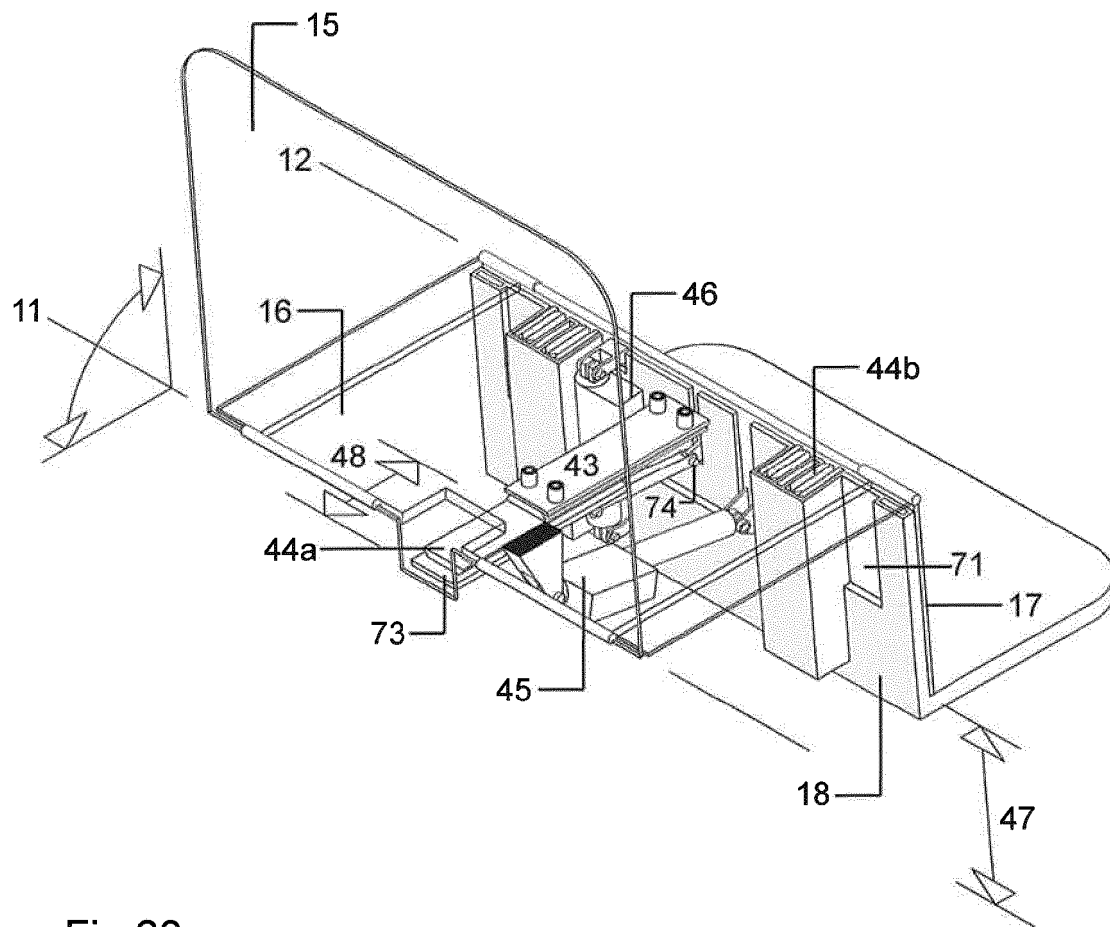


Fig.23

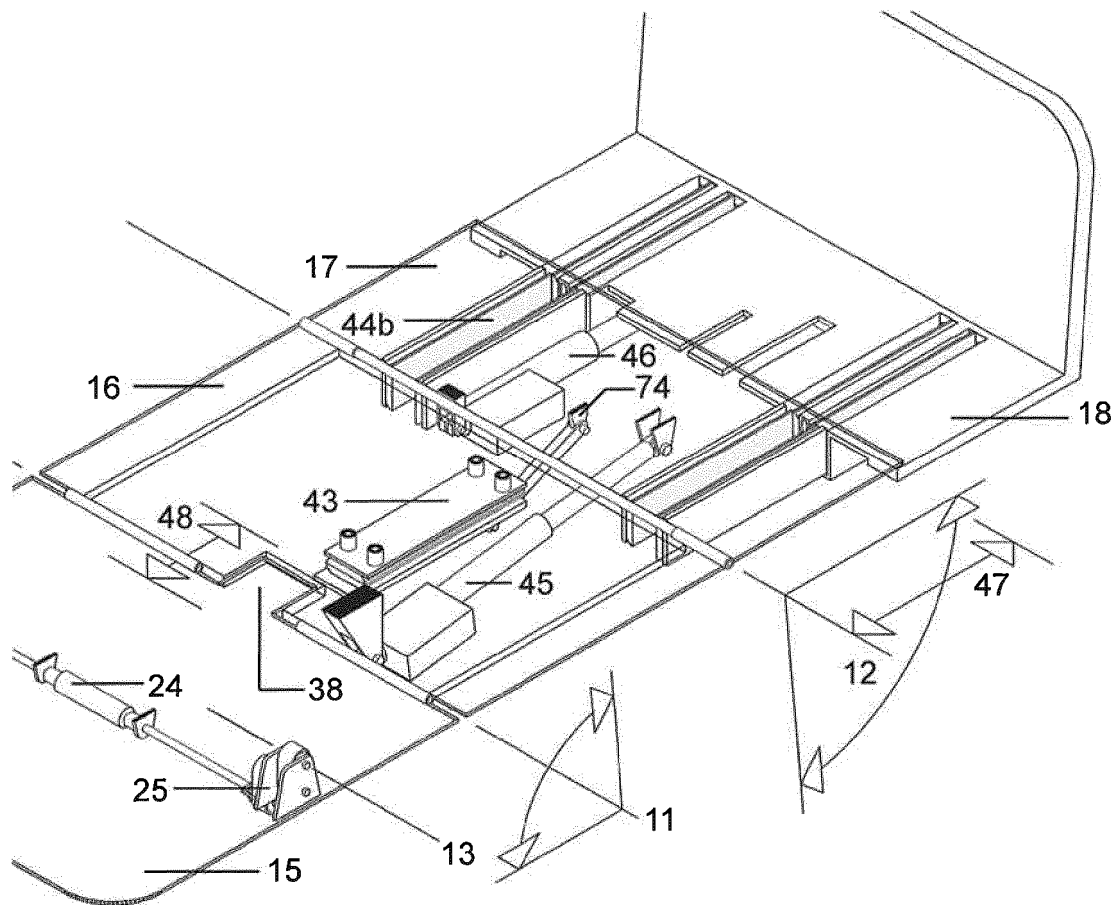


Fig. 24

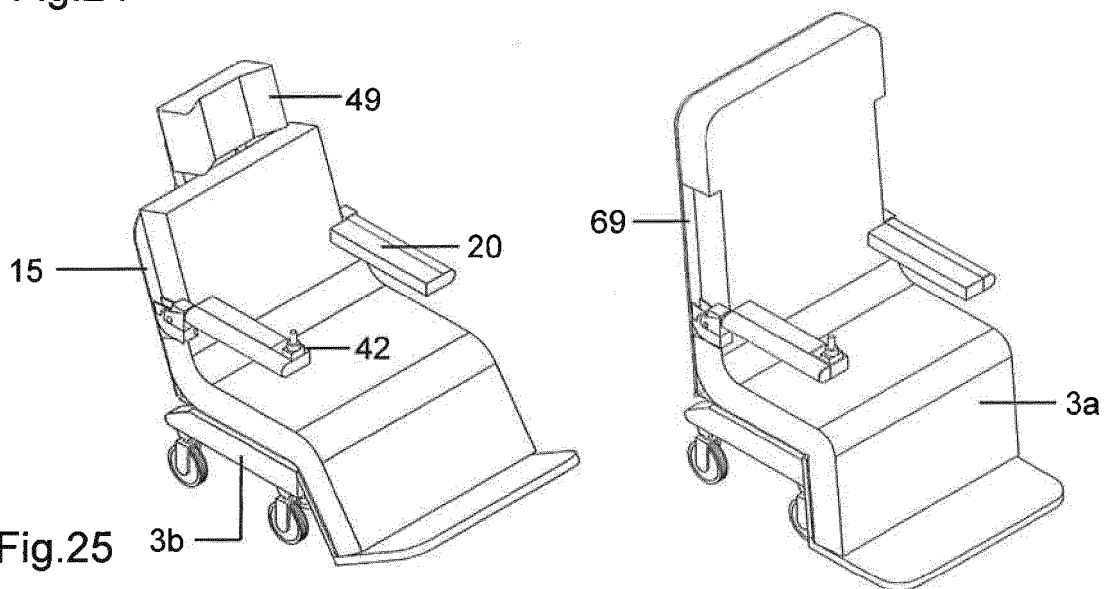


Fig. 25

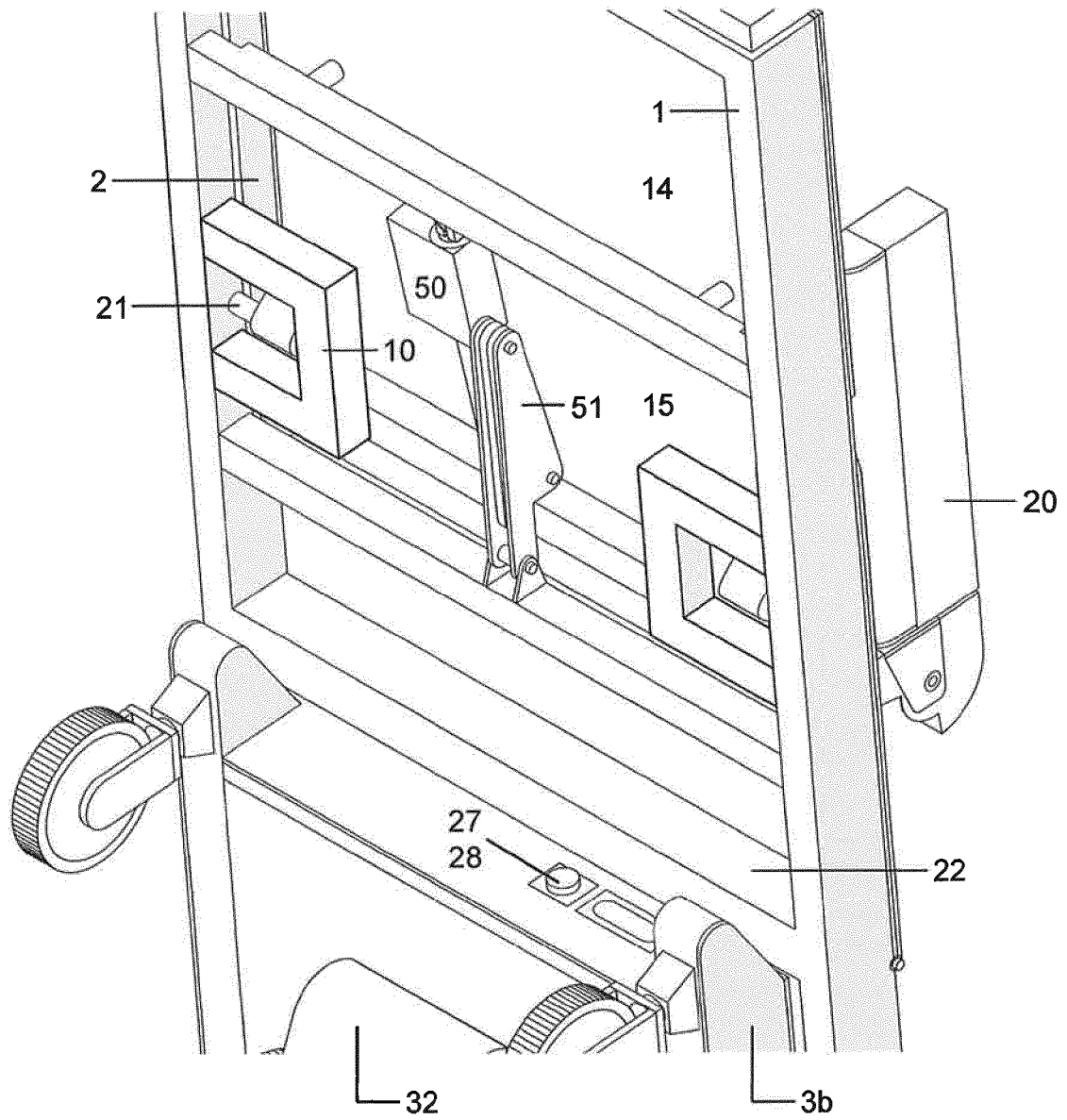


Fig.26

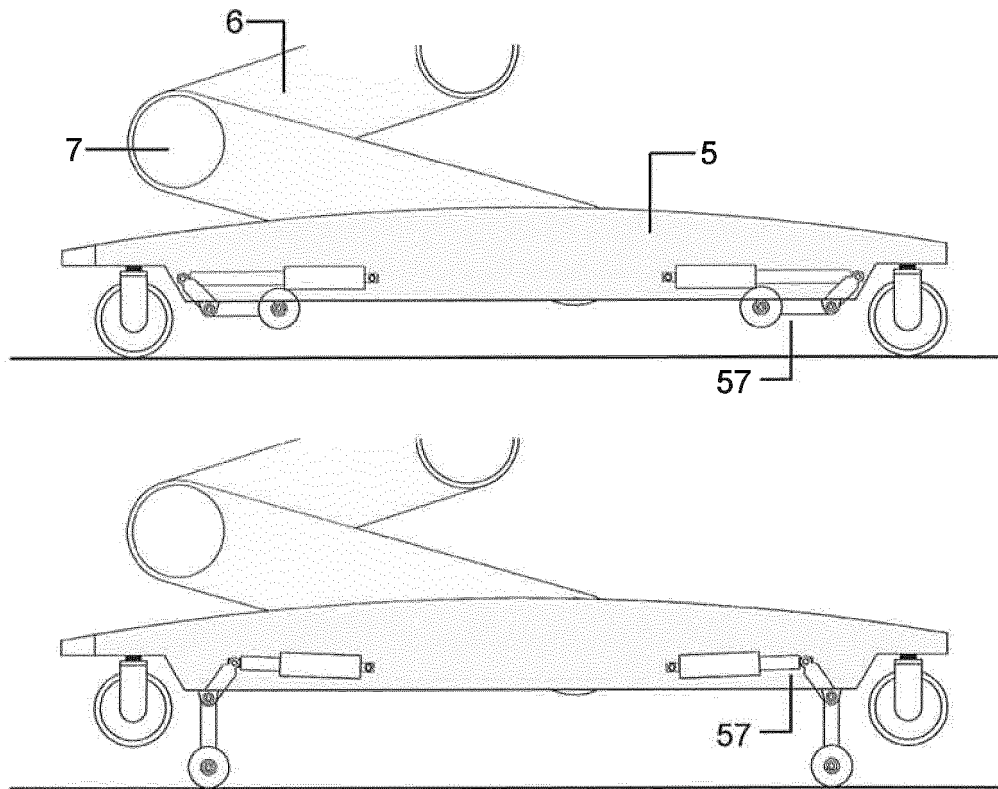


Fig.27

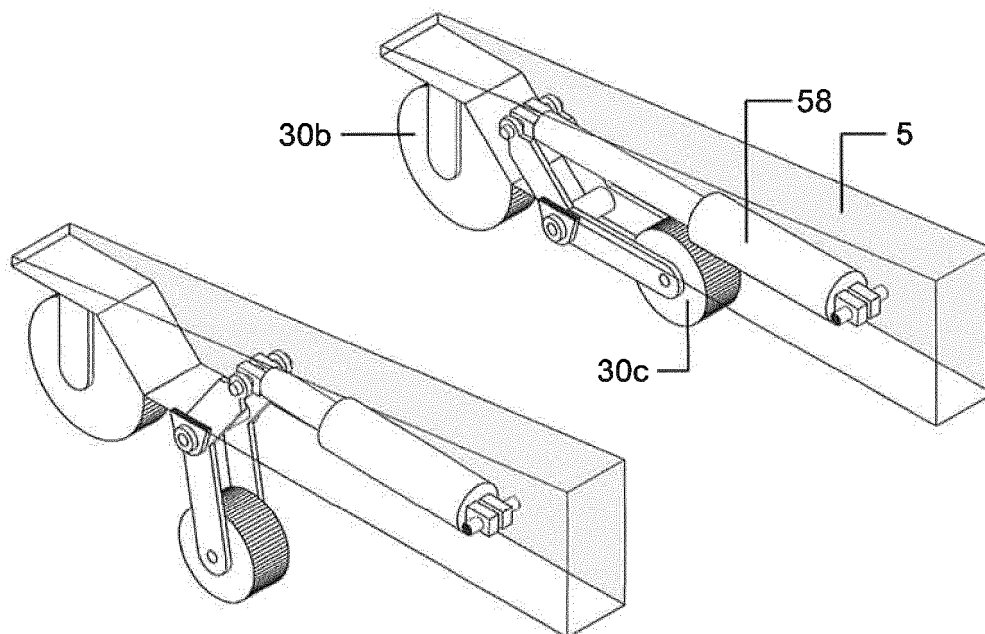


Fig.28

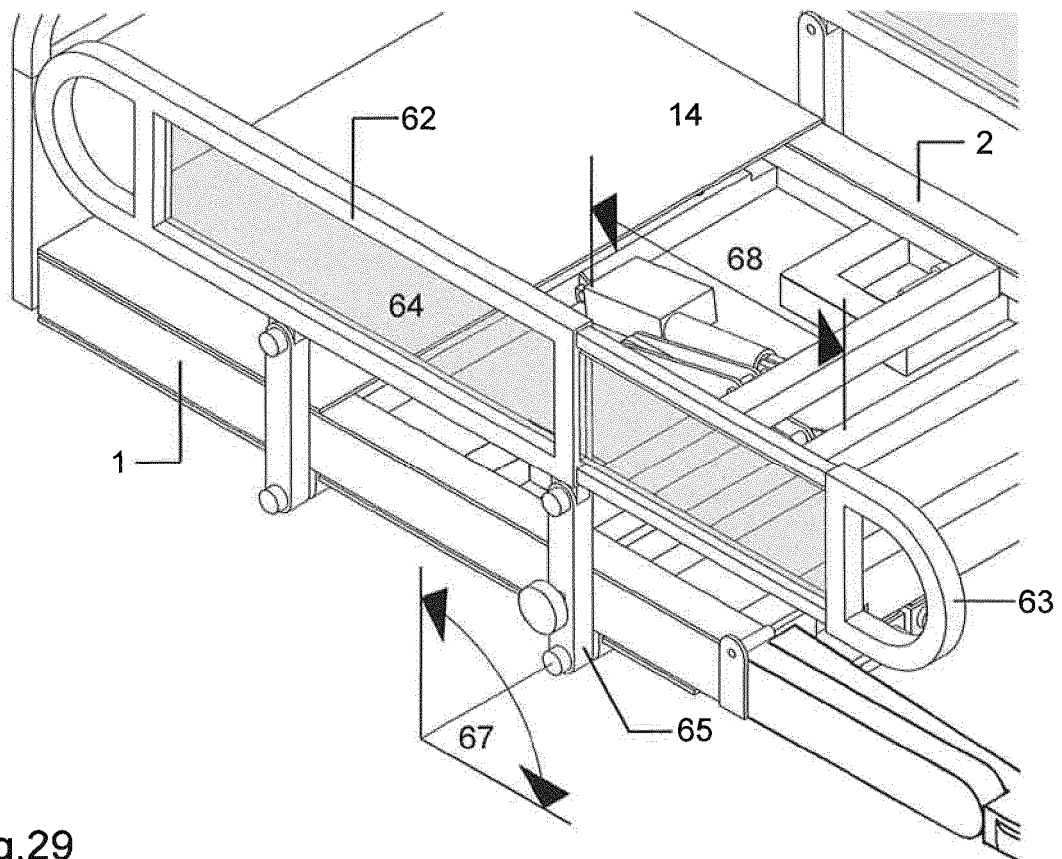


Fig.29

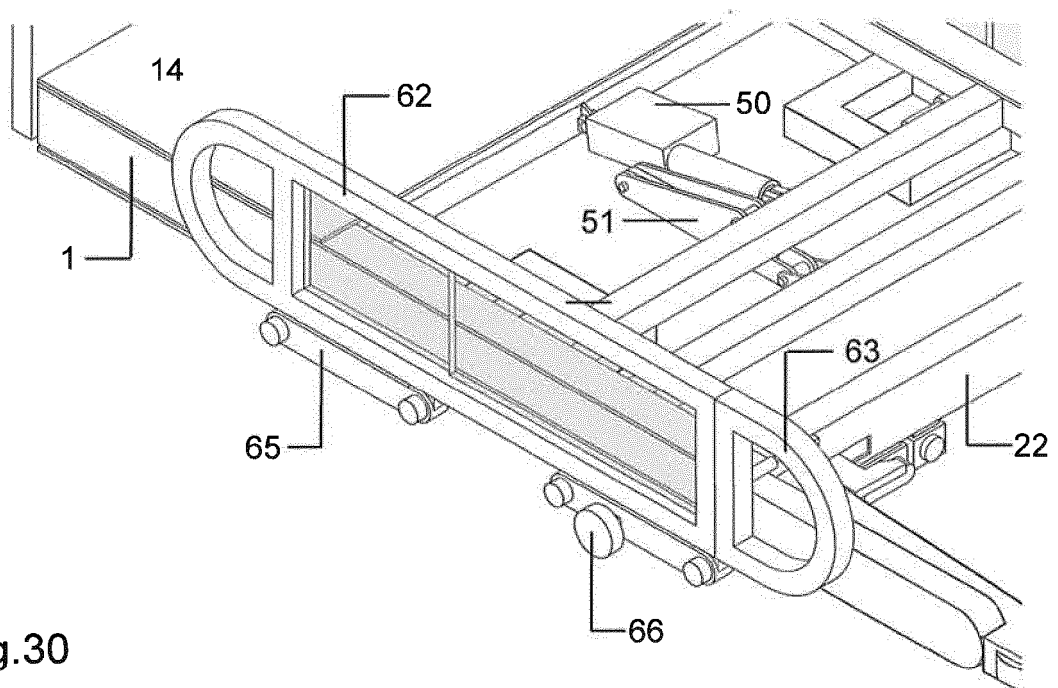


Fig.30

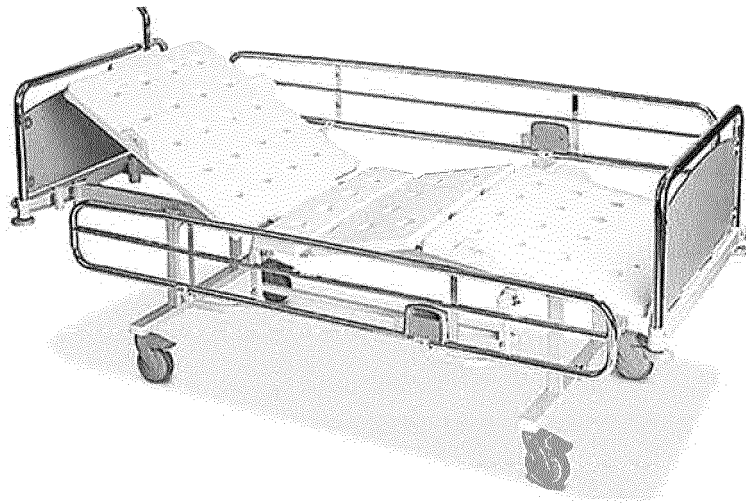


Fig.31

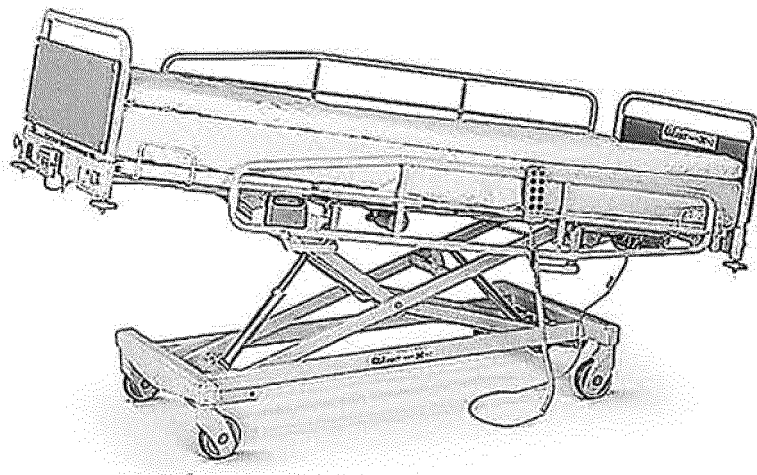


Fig.32

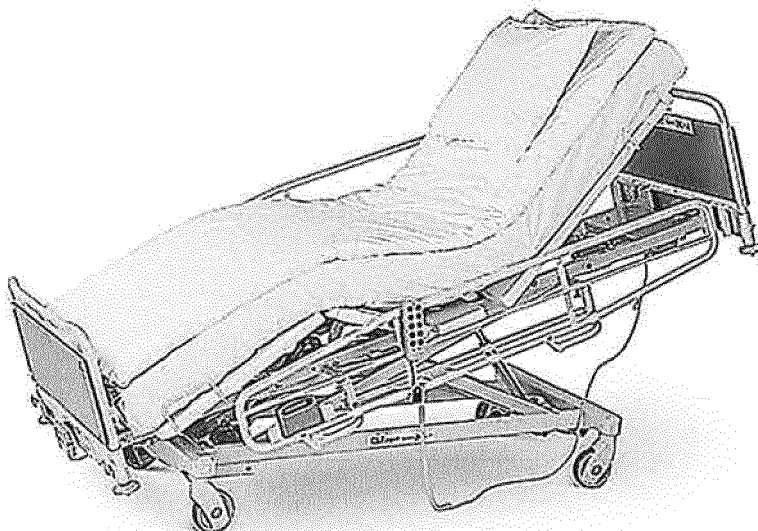


Fig.33

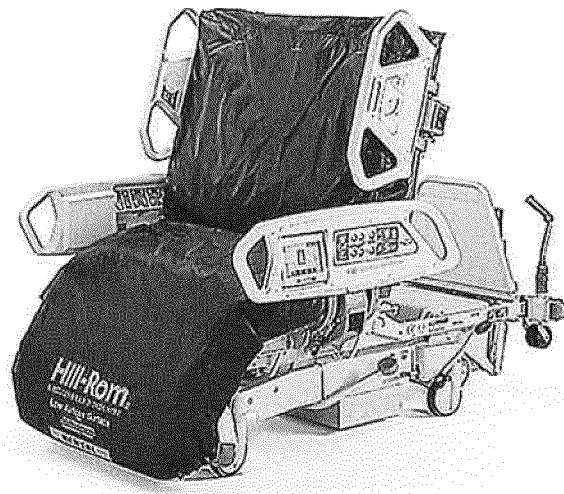


Fig.34



Fig.35a

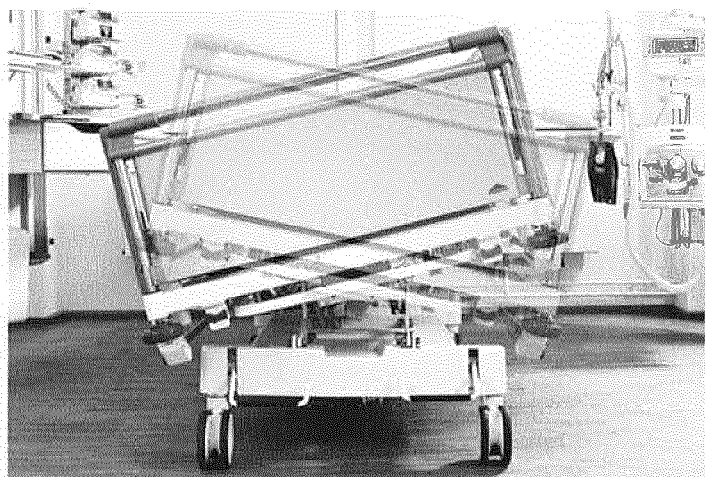


Fig.35b

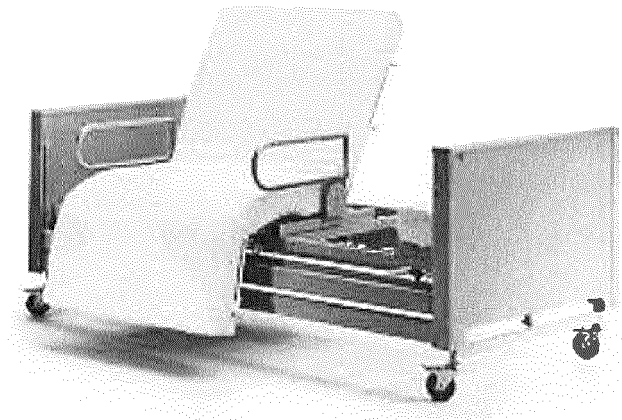


Fig.36

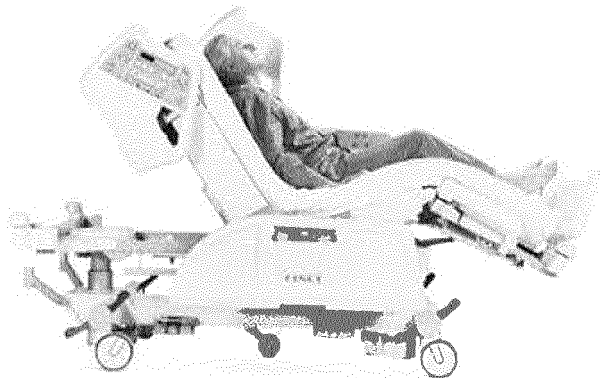


Fig.37



Fig.38

Fig.39

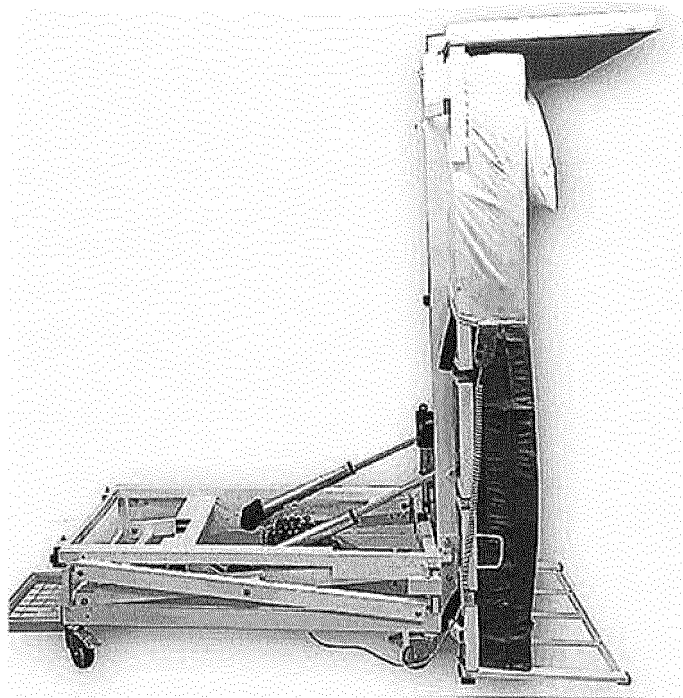


Fig.40



Fig.41



Fig.42

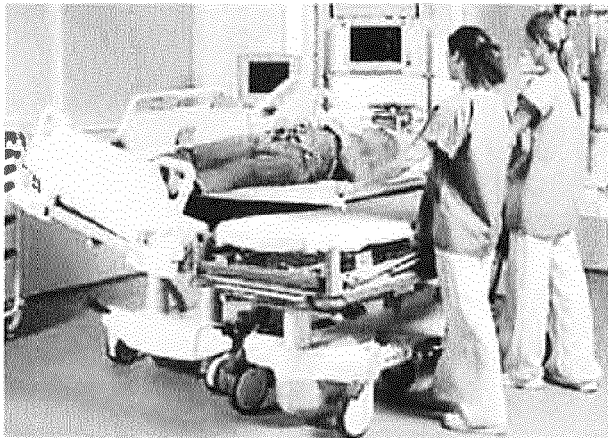


Fig.43



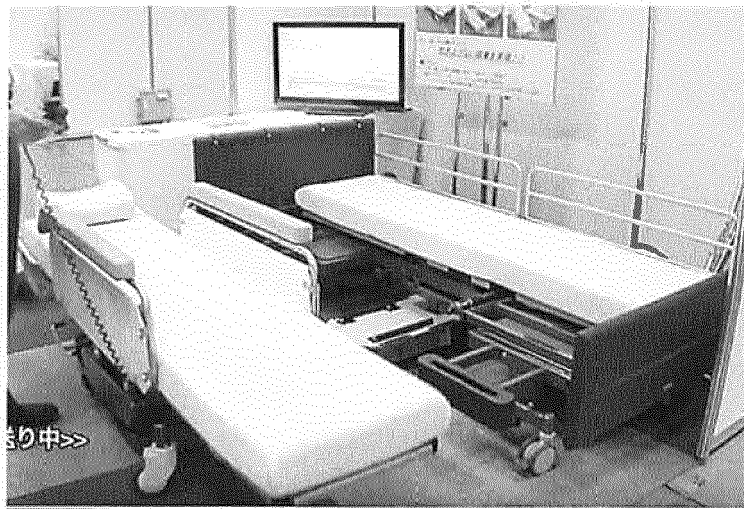


Fig.44

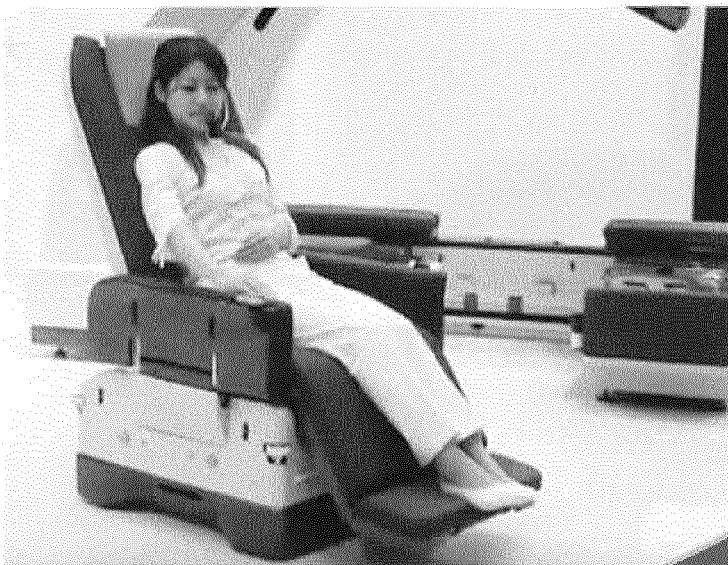
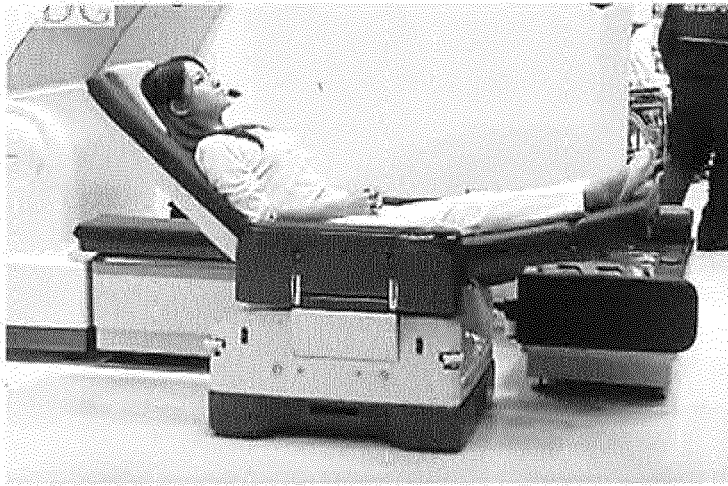


Fig.45

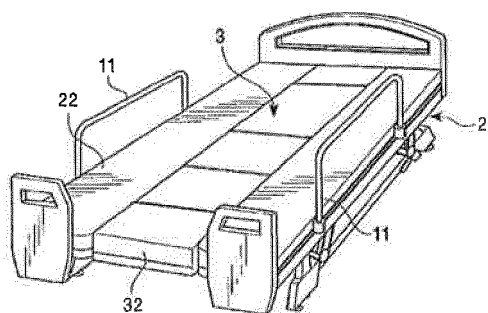


Fig.47

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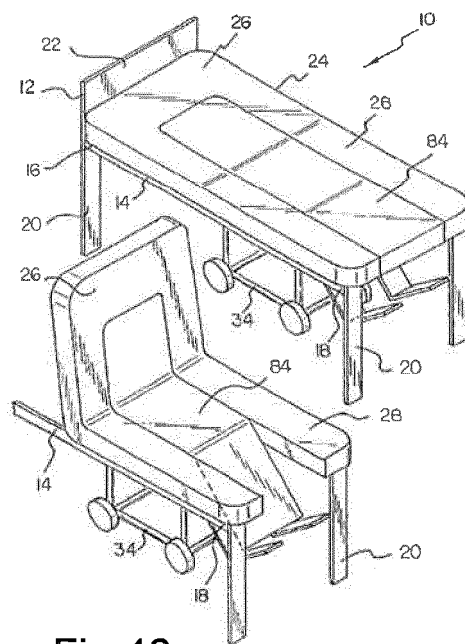
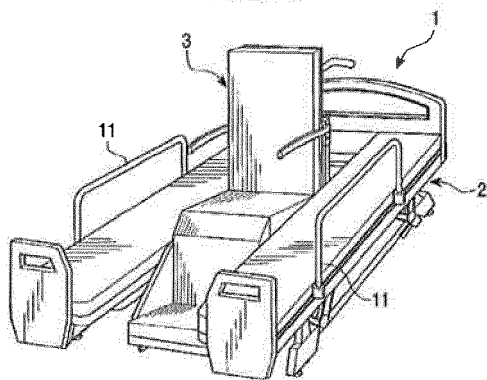


Fig.46

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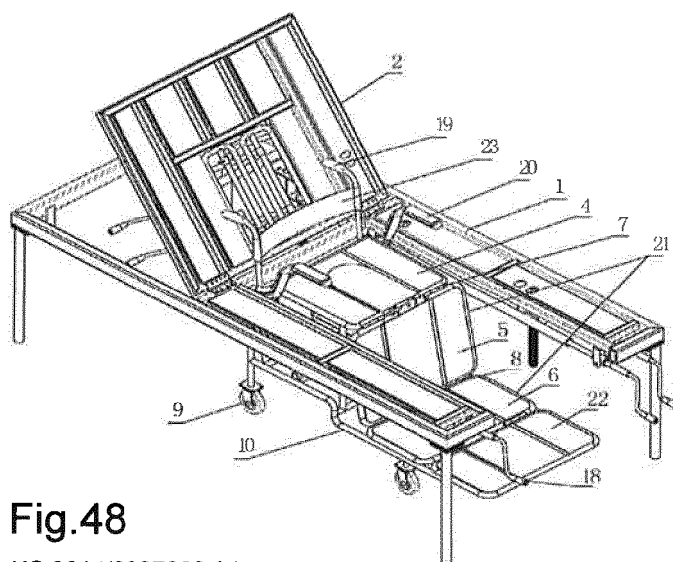


Fig.48

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REFERENCES CITED IN THE DESCRIPTION

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